101/52

INTERNATIONAL STANDARDIZATION: THE FEDERAL ROLE

HEARING

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

JULY 25, 1989

[No. 52]

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Committee on Science, Space, and Technology

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INTERNATIONAL STANDARDIZATION: THE FEDERAL ROLE

TUESDAY, JULY 25, 1989

House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:43 a.m., in room 2318, Rayburn House Office Building, Hon. Doug Walgren [chairman of the subcommittee] presiding.

Mr. **Walgren**. Good morning, and let me call us to order this morning for this hearing of the Science, Research, and Technology Subcommittee on International Standards.

Europe, in 1992, as you all know, and whether we like it or not, will unavoidably change the foundations of world trade as over 12 nations, and maybe more to follow, are agreeing to tear down all internal trade barriers so that a product sold in one country will automatically be marketable in every other country in that group.

For trade purposes, we will be facing in the nineties the United States of Europe, a legal entity that will be richer and more populous than the United States of America, and this is the first time in many years that the United States has not been the richest and the largest market in the world. From overseas, we are beginning to realize that we are simply one of several major players in world trade. We are certainly still large enough to be taken seriously, but we are no longer large enough certainly to determine what the rules of international trade will be merely because we dominate the marketplace.

These rules underlying international trade, or the rules that underlie international trade and will underlie it increasingly in the future, are international standards. Standards can be used to facilitate commerce or to create barriers. If written by one side, they can favor that nation or group of nations and their products in world markets, and, if written by the other, disadvantage them.

Up until the 1960's, U.S. standards, promulgated by voluntary consensus standards organizations, were essentially dominant and preeminent throughout much of the world. There was little incentive for the United States to be a serious major player in various international standards organizations, but that is certainly no longer the situation.

The merging of Western Europe into a single market has made governmental roles in international standards development far more important than it has been in the past. It has created a formidable block of nations voting together, it has brought together several of the nations which invest most heavily in international standards, often with funds and/or coordinated action from their governments, and these countries also work to export their standards to developing countries as well to enhance their markets.

We certainly must reconsider the United States' role and our way of participating in the international standards area, and I was happy to learn that the Commerce Department is following this committee's lead by holding a similar examination of international standards internally tomorrow.

We will consider two specific issues today: one, the role of the U.S. Government in international standards development, and the role of our Government in assisting developing nations in the writing of their own standards and codes.

Our first witness will be Congressman Mervyn Dymally from California, who will discuss with us the situations faced by a number of developing nations. Congressman Dymally has been involved directly in efforts to raise this question with the Congress, and he has focused our attention on it in a way that was reflected in the Committee's actions in the last Congress, but we have been unable, despite the cooperation we have had from other Members, to get the Commerce Department to fully respond to the circumstances that Congressman Dymally has raised, and we hope to work with him in trying to get a good resolution of that situation in the future.

As Congressman Dymally has pointed out, there are a number of countries that are begging us to send American experts in standards so that our goods will have a place in their marketplace. We have been unable to get the Commerce Department to respond fully to that need, and we want to work on that problem aggressively with Congressman Dymally.

After Congressman Dymally testifies, we will suspend the formal hearing while we listen to a very special guest, John Woods, the Director of the Standards Council of Canada, who has joined us this morning to share his experiences and the perspectives of somebody working on that level in our neighbor to the north.

Canada, a few years ago, wrestled with the same question that we face this morning, and Mr. Woods' organization has emerged as a very direct player in the solution that Canada has developed. The U.S.-Canada Fair Trade Agreement brings the Canadian market even closer to the United States, so we certainly appreciate the willingness of Mr. Woods to come and share some informal thoughts with us.

After that, we will resume the formal hearing with Ray Kammer, the Acting Director of the National Institute of Standards and Technology and, following that, a range of witnesses that make up a cross section of the private sector standards community: Mr. Peralta of the American National Standards Institute, Mr. O'Grady of the American Society for Testing Materials, Ms. Wood of the IEEE Computer Society representing three of the biggest organizations in international standards activity today, and then we will conclude with a panel made up of representatives of technical standards committees, and we hope that all the witnesses will share their ideas and their concerns, what they find working well and what they find their problems are, with the committee.

We would like to make as focused a contribution as we can in this area along with the many other organizations involved in international standards to assure that the United States certainly takes or makes the role that standards play in international trade a role that not only promotes the international economy but certainly does nothing to disadvantage and everything that could fairly advantage American products in the international market.

Well, with that, let me invite other Members, if they would like, to make any opening comments before we turn to Mr. Dymally.

The Congresswoman from Maryland, Mrs. Morella.

[The prepared opening statement of Mr. Walgren follows:]

OPENING REMARKS OF THE HONORABLE DOUG WALGREN (D-PA) ON INTERNATIONAL STANDARDS HEARING

EUROPE 1992, WHETHER WE LIKE IT OR NOT UNAVOIDABLY WILL SHAKE THE FOUNDATIONS OF WORLD TRADE. OVER A DOZEN NATIONS, AND MAYBE MORE TO FOLLOW, ARE AGREEING TO TEAR DOWN ALL INTERNAL TRADE BARRIERS SO THAT A PRODUCT SOLD IN ONE COUNTRY AUTOMATICALLY IS MARKETABLE IN EVERY OTHER ONE. FOR TRADE PURPOSES, WE ARE FACING THE UNITED STATES OF EUROPE, A LEGAL ENTITY WHICH IS RICHER AND MORE POPULOUS THAN WE ARE. THIS IS THE FIRST TIME IN MANY YEARS THAT THE UNITED STATES HAS NOT HAD THE RICHEST AND LARGEST MARKET IN THE WORLD. FROM OVERSEAS, WE ARE BEGINNING TO LOOK MORE LIKE A 300 POUND TACKLE THAN AN 800 POUND GORILLA. WE ARE CERTAINLY STILL BIG ENOUGH TO BE TAKEN SERIOUSLY, BUT WE ARE NO LONGER BIG ENOUGH TO DICTATE THE RULES OF INTERNATIONAL TRADE MERELY BECAUSE WE ARE MORE POWERFUL THAN EVERYONE ELSE.

THESE RULES UNDERLYING INTERNATIONAL TRADE ARE INTERNATIONAL STANDARDS. STANDARDS CAN BE USED TO FACILITATE COMMERCE OR TO CREATE BARRIERS. IF WRITTEN BY ONE SIDE, THEY CAN FAVOR THAT NATION OR GROUP OF NATIONS' PRODUCTS IN WORLD MARKETS.

UP UNTIL THE 1960'S, U.S. STANDARDS, PROMULGATED BY VOLUNTARY CONSENSUS STANDARDS ORGANIZATIONS, WERE PREEMINENT THROUGHOUT MUCH OF THE WORLD. THERE WAS LITTLE INCENTIVE FOR THE U.S. TO BE A MAJOR PLAYER IN THE VARIOUS INTERNATIONAL STANDARDS ORGANIZATIONS.

HOWEVER, THAT IS NO LONGER THE SITUATION. THE MERGING OF WESTERN EUROPE INTO A SINGLE MARKET HAS MADE GOVERNMENTAL ROLES IN INTERNATIONAL STANDARDS DEVELOPMENT MUCH MORE IMPORTANT THAN IN THE PAST. IT HAS CREATED A FORMIDABLE BLOCK OF NATIONS VOTING TOGETHER. IT HAS BROUGHT TOGETHER SEVERAL OF THE NATIONS WHICH INVEST MOST HEAVILY IN INTERNATIONAL STANDARDS OFTEN WITH FUNDS AND/OR COORDINATION FROM THEIR GOVERNMENTS. THESE COUNTRIES ALSO WORK TO EXPORT THEIR STANDARDS TO DEVELOPING COUNTRIES.

WE HAVE NO CHOICE BUT TO RECONSIDER THE U.S. ROLE AND METHOD OF PARTICIPATING IN THE INTERNATIONAL STANDARDS ARENA, AND I WAS HAPPY TO LEARN THAT THE COMMERCE DEPARTMENT IS FOLLOWING THIS COMMITTEE'S LEAD BY HOLDING INTERNATIONAL STANDARDS HEARINGS TOMORROW.

WE WILL CONSIDER TWO SPECIFIC ISSUES TODAY: THE ROLE OF THE U.S. GOVERNMENT IN INTERNATIONAL STANDARDS DEVELOPMENT AND THE ROLE OF OUR GOVERNMENT IN ASSISTING DEVELOPING NATIONS IN THE WRITING OF THEIR OWN STANDARDS CODES. CONGRESSMAN DYMALLY WILL BE OUR LEAD WITNESS REGARDING DEVELOPING

NATIONS. HE HAS DONE MUCH TO SENSITIZE THE CONGRESS AND INDEED THE NATION TO THE PROBLEMS WE WILL FACE IF WE CONTINUE NOT TO BE PLAYERS IN THIS IMPORTANT ARENA.

COUNTRIES ARE BEGGING US TO SEND IN EXPERTS AND HOPEFULLY, WE NOW WILL START TO LISTEN. A REPRESENTATIVE OF WESTINGHOUSE ELECTRIC WHO HAS HAD A LONG CAREER MARKETING OVERSEAS WILL ALSO ADDRESS THIS PROBLEM.

AFTER CONGRESSMAN DYMALLY TESTIFIES, WE WILL RECESS THE FORMAL HEARING WHILE WE LISTEN TO AND ASK QUESTIONS OF A VERY SPECIAL EXPERT. JOHN WOODS, THE DIRECTOR OF THE STANDARDS COUNCIL OF CANADA, HAS JOINED US THIS MORNING TO SHARE HIS EXPERIENCES. CANADA A FEW YEARS AGO WRESTLED WITH THE SAME QUESTION WE FACT THIS MORNING AND MR. WOODS' ORGANIZATION EMERGED AS A VERY SATISFACTORY SOLUTION FOR THEM. THE U.S./CANADA FAIR TRADE AGREEMENT, OF COURSE, BRINGS MR. WOODS EVEN CLOSER TO US SO WE ARE GRATEFUL FOR HIS WILLINGNESS TO BE WITH US. MR. WOODS WILL BE AN INTEGRAL PART OF OUR PROCEEDINGS HERE TODAY. RAY KAMMER, THE ACTING DIRECTOR OF OUR NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY WILL TESTIFY FOLLOWING OUR DISCUSSION WITH MR. WOODS.

THE REST OF OUR WITNESSES ARE A CROSS-SECTION OF THE PRIVATE SECTOR STANDARDS COMMUNITY. MR. PERALTA OF THE AMERICAN NATIONAL STANDARDS INSTITUTE, MR. O'GRADY OF THE

AMERICAN SOCIETY FOR TESTING AND MATERIALS, AND MS. WOOD OF THE IEEE COMPUTER SOCIETY REPRESENT THREE OF THE BIGGEST ORGANIZATIONS IN INTERNATIONAL STANDARDS TODAY. OUR FINAL PANEL INCLUDES REPRESENTATIVES OF STANDARDS TECHNICAL COMMITTEES. WE HOPE YOU WILL SHARE YOUR IDEAS AND DREAMS WITH US. PLEASE TELL US WHAT IS WORKING WELL. PLEASE SHARE YOUR PROBLEMS. WE WOULD LIKE TO WORK WITH YOU AND THE MANY OTHER ORGANIZATIONS INVOLVED IN INTERNATIONAL STANDARDS TO ASSURE THAT THE U.S. IS SECOND TO NONE AS A SKILLFUL ADVOCATE AND PROMOTER OF ITS BEST INTERESTS IN ALL ASPECTS OF INTERNATIONAL STANDARDS.

Mrs. **Morella**. Thank you.

Mr. Chairman, I don't have any opening comments, except to say that I am pleased that this is the subject that we are going to discuss today.

I am honored, as you know, to represent the National Institute of Standards and Technology in Maryland's Eighth Congressional District, and I have always felt that the role of standards and measurement and certainly international standards has been the best kept secret, and so we will find out today, become more enlightened in terms of what the Federal role is by listening to the experts.

I want to certainly welcome our colleague, Congressman Dymally, with whom I work so closely on Post Office, Civil Service, and other matters, and the other witnesses that you have so skillfully put together.

So I thank you, Mr. Chairman.

Mr. **Walgren**. Thank you, Mrs. Morella, and we want to welcome today our new Member of Congress, a new Member of this Committee, Congressman Browder from Alabama.

We are pleased you are here and look forward to having you participate in our processes.

Mr. **Browder**. Thank you, Mr. Chairman.

I look forward to working with you and this Committee as we face the important problems facing Congress and our country.

Thank you.

[The prepared opening statement of Mr. Costello follows:]

OPENING STATEMENT

BY U.S. REP. JERRY COSTELLO

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

JULY 25, 1989

"INTERNATIONAL STANDARDS AND U.S. COMPETITIVENESS"

Mr. Chairman, the subject of competitiveness touches every American. Many Americans do not understand how international product standards influence our competitiveness.

Today's hearing will help to bring this problem into focus. It is important that we determine how to make our products more attractive in overseas markets and just how much the federal government should be involved in the setting of international standards.

With our trade deficit in mind, I look forward to today's testimony. What is said here may have an enormous impact on the future of America in the world marketplace.

Mr. Walgren. Let me welcome formally then Congressman Dymally.

We are really pleased you are here, Merv. You have a history of involvement in the efforts of American exporters over the years, and former Members of Congress have come to me after they have seen you in this particular problem involving the Saudi Arabians and the like. I certainly appreciate and want to salute the attention that you have given to this and hope that we can contribute something to your efforts that will make things work out better for American exporters.

We welcome you to the Committee.

STATEMENT OF HON. MERVYN M. DYMALLY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. Dymally. Thank you very much, Mr. Chairman.

First, I want to thank you for holding these hearings, and I confess to you that standards is not something in which I have any expertise. In fact, I just came about the whole concept about two or three years ago on a very casual visit to the Middle East, and it struck me as rather strange that the United States did not have a presence in the standards field in those Middle East countries which I visited.

I recall this Easter recess Mrs. Morella and I attended an institute in Bermuda, and I remarked to her how my blood boils when I go to foreign countries and only see foreign products. In fact, we were looking at all the automobiles in Bermuda which were not even British, they were Asian automobiles, and I said to her, "Gee, you know, I travel around the world, and when I was much younger all we saw were American products, and now all we see are foreign products in countries which are very friendly to us." So it was with this curiosity in mind that I became interested in this and the request of some of the people with whom I spoke in the Middle East about our lack of presence in their areas, and so I began looking at this issue and saw it really multiplied in terms of jobs affecting my own district, which was probably the largest aerospace district in the United States, and so, as a result of that, I became interested in this issue.

As I said before, I don't have any expertise, but I just want to point out to you something I viewed from a lay perspective. The standards for honey, plain old honey, are written by Germany, and so in foreign countries we must follow German standards to sell our honey. For refrigerators in the Middle East, the standards for the extension cord are Japanese, so we must either not export refrigerators, which is the case, or develop shorter cords for refrigerators.

Now these are just two very simple examples of how important standards are. The result is that we are not exporting any refrigerators to some Middle East countries because the Japanese are present, the Germans are present, the British are present in those countries. I mean physical, human life presence when these standards are developed, and they influence these standards. We don't have a presence.

Why don't we have a presence? Because the Department of Commerce takes the position that this is a private sector initiative, and indeed it is, and they are, I presume, fearful that there would be Government control. Now this is not what we are asking. We are not asking the Department of Commerce to develop standards. We are simply saying, "We want you to have a presence, to talk to these foreign countries about our standards, why it is you should have a longer refrigeration cord or why honey should have an international standard or, more personally, an American standard. Why are we selling Riverside honey through German standards?" And so it boils down to very simplistic terms.

Now the private sector, of course, has its fears about Government interference, but I think those fears now are eradicated. So we are hopeful that the Department of Commerce would understand that we are talking about thousands of jobs and billions of dollars' worth of trade not only just to the Middle East but other countries. Just the Caribbean: We used to dominate the business in the Caribbean. Automobiles used to be all American automobiles. Now we have no American automobiles there. And so it goes all over the world. We are losing ground because of our failure to have a presence.

So let me conclude, Mr. Chairman, and ask you to enter into the record my formal statement with a message to the Department of Commerce that the Congress—certainly I am not—embark on a program of getting the United States Government to write standards. We hope this will continue to be the exclusive domain of the private sector. We are simply saying that, where we recognize that the private sector has a vested interest in this, we have a larger interest to our citizens, our constituents, who gain jobs as a result of the development of American or international standards and not standards confined to one country or to one region and that we are hoping that they will support this effort to put some money into the budget, to put some presence in foreign countries, so that when standards are written we can say to those foreign countries, "We think you ought to extend this cord another six inches because..." x, y, and z.

Thank you very much. I am very impressed with the witnesses you have brought together and the large number of people who have come to listen to the testimony. It shows that there is a lot of interest out there on this subject.

[The prepared statement of Mr. Dymally, plus a copy of the bill H.R. 2468 follow:]

TESTIMONY

OF

THE HONORABLE MERVYN M. DYMALLY (D-CA)

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

"INTERNATIONAL STANDARDS"

JULY 25, 1989

Before I begin my testimony, Mr. Chairman, I would like to take a minute to complement you on conducting this hearing to address the important question of United States participation in standards development within the international arena.

I believe it is an important question which in recent years has gained further importance in determining access to export markets. Since the seventies, awareness of the importance of industrial standards as a form of trade barriers or facilitators was demonstrated in the adoption of the Trade Agreement Act of 1979. USCA 19 section 2545 authorized grants and contracts:

"..to facilitate international trade through the appropriate international and domestic standards-related activities."

"..to encourage United States exports through increased awareness of foreign standards-related activities that may affect United States exports."

In its report to Congress requested in Section 112 of P.L. 100-519, the National Institute of Standards and Technology (NIST) confirmed the importance of industrial standards in international trade as more countries either require compliance with standards, that were either non-existant or voluntary, or require that certificates of conformity to their national standards should accompany the exported products. You can imagine the hardship this causes our manufacturers, many of whom are too small to have overseas staff in place to help them through the maze of increased bureaucratic regulation.

And more recently, The Trade Act of 1988 clearly stated that the role of NIST is to "cooperate...with the governments of other nations and international organizations...in establishing standard practices, codes, specifications, and voluntary consensus standards." This provision demonstrates Congressional awareness of the role played by standards in export promotion. It also indicates the vested authority in NIST as the appropriate government agency to assist U.S. businesses with interim standards development as it pertains to the export market.

As you know, our trade deficit in 1988 was $119 billion; recent trade figures for the month of May suggest that 1989 may not be much better. According to 1986 Department of Commerce figures, at least 4.6 million American jobs depend on exports. Yet, since 1981 we have lost 700,000 manufacturing jobs, many of them to our foreign competitors. Mr. Chairman, to do everything we can to enhance our exports is more important now than ever. According to a recent article in the Journal of Commerce, it is estimated that exports in 1989 are expected to increase by only 15% compared to 23% in 1988. This increases the need for the adoption of other initiatives to maintain and expand our exports.

With this in mind, our participation in setting standards within the international arena takes paramount importance. In recent years, such diverse countries, as Saudi Arabia, Brazil, Israel and India, have sought our assistance in developing their industrial standards. The National Institute of Standards and Technology, however, was unable to respond to these requests despite bipartisan Congressional support for a request which impacted a $5.7 billion dollar market and affected over 160,000 U.S.- based jobs.

At the present time, Saudi Arabia has the most comprehensive standards development program which encompasses both the manufacturering and agricultural sectors. More than 10 years ago this country embarked on developing its national mandatory product standards. The job was entrusted to the Saudi Arabian Standards Organization (SASO) which sought technical assistance from industrialized nations. Once these standards are completed the rest of the Gulf Cooperation Council countries, which include Kuwait, Bahrain, Oman, Qatar, and the United Arab Emirates, are also expected to adopt these standards.

After the Saudi's initiative, several countries , who routinely compete for our export market, sent teams of experts to assist SASO in devising these industrial standards. European and Japanese competitors provided the technical assistance gratis on a government-to-government basis with the hope that the standards adopted would be compatible with their own products. They succeeded. Not only are these standards compatible with their products but standards already adopted by SASO, based on information supplied by our competitors, are incompatiable with our own manufactured goods.

Here are some examples of problems encountered by American firms when Saudi customs officials enforced the standards adopted by SASO.

* Most electrical equipment brands in Saudi stores are now either

of European or Japanese origin or American brands manufactured outside the United States.

*According to a communique from our commercial attache in Saudi Arabia, none of the electrical appliances currently imported from the U.S. meet Saudi standards. If SASO strictly intepreted standards for appliances, as they now stand, including the 127 voltage requirement, all shipments of appliances from the United States would cease immediately, resulting in the loss of millions of dollars in export earnings. This assessment is not mine, Mr. Chairman, but it is based on information provided to our Embassy by General Electric.

In an era, in which the American family farmer is struggling for survival, the export of agricultural commodities may mean the difference between success and failure for a farmer. Even where products that can easily be produced by our family farmers, our lack of participation in standards development hurts our agricultural exports. More and more food items are also being excluded because of strict Saudi customs interpretation of standards for shelf-life.

*For example, the standard for honey, adopted by SASO ,was written by a German specialist using German supplied testing equipment. Now, U.S. suppliers are forced to manufacture honey according to European standards in order to be competitive. I might add, here, that the U.S, standard, in terms of purity, is superior to the European version. Our standard does not contain corn syrup and has a much lower ash content.

*In another case, a bean exporter, with a 20 year history of exporting his produce is no longer able to do so because he packs his beans in oil rather than water, as required by the new SASO standard. Without an American standards expert in place, there was no one to oppose the standards change for canned produce.

Last year, I offered an amendment to the National Institute of Standards and Technology Authorization Act for FY1989 which required the Secretary of Commerce to initiate a pilot-program to assist developing nations in establishing their product standards. Because of the crisis nature of the SASO situation, I sought to create a program which would place an American standards expert "on-site", with the expectation that this initiative would be funded by the private sector. At the same time, part B of section 112 of the NIST authorization requested a study of the ways NIST can respond to similar requests from other major trading partners, or potential major export markets, and possible funding sources. It was hoped that this study would encourage the Department of Commerce to request Congressional support for a program which would assist major trading partners in developing their standards. In fact, such a program was recommended by a delegation from the National Bureau of Standards and the private sector, represented by the American Society for Testing and Materials (ASTM).

As you know, Mr. Chairman, Commerce has failed to create the pilot program authorized by my amendment. Additionally, the Department's study urged that requests from other governments, for assistance with their standards development, be handled by a private foundation developed specifically for this purpose. I, respectfully, disagree with this approach for enhancing our nation's export potential.

I firmly believe that our export market is much too important and it affects too many American jobs, to be left solely to the private sector. Let me say that the private sector has demonstrated its interest in the program, this year, by contributing $180,000. Nevertheless, as the FORBES April 17, 1989 article indicates "things are not going well". I would like to seek permission to include this article in the hearing record.

Additionally, my understanding is that NIST has been unable to respond to these requests for assistance from developing countries because it lacked the resources. In an article published by the Journal of Commerce, the National Association of Manufacturers (NAM) supported the establishment of this program but criticized its funding from the private sector as a short-term solution. NAM argued that "...the U.S. government must assist exporters at this most basic level in keeping with its policy to promote exports". I would also like to request that this article be included in the hearing record.

That is why I introduced H.R.2468 to authorize funding at $200,000 in fiscal years 1990, 1991, and 1992 to support a standards expert. Let me stress that while H.R 2468 would authorize $200,000 for the standards expert program, this authorization does not mean that the government must fund all the expenses associated with this program. If fully funded, this amount would cover the costs of one "on-site" standards expert in Saudi Arabia. This expert will have to call on the private sector for additional support either by providing copies of American standards or by sending experts on an industry-specific basis.

Mr. Chairman, the U.S. once dominated trade with Saudi Arabia. We have since been replaced by Japan. Great Britian, West Germany and France have all sent teams of standards professionals to advise SASO on developing product standards. Yet, despite that government's offer to provide housing, office and local travel costs for a U.S. expert, Commerce has repeatedly refused to send a standards expert to compete with the British, the Germans and the French. Mr. Chairman, clearly a private foundation is not the answer. Not only will our businesses continue to be outpaced by foreign competitors, but large corporations, under the NIST proposal, would have a decided disadvantage over the small business owner. I believe that H.R. 2468 offers a reasonable approach to assisting our businesses on the product standards issue. I urge this Subcommittee to include this measure as part of NIST's reauthorization.

Again, I would like to thank you Mr. Chairman and the distinguished ranking Minority Member for your leadership and past support on this issue.

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and Commercial

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★ ★ ★ ★ ★ MONDAY, OCTOBER 31, 1988 162ND YEAR ONE DOLLAR

Biochemical Firms See Need Set Up Shop in EC Before '92

LL MONGELLUZZO
urnal of Commerce Staff

NADO, Calif. — Smaller
cal and pharmaceutical
y find significant opportu-
profit if they establish a
in Europe before the 12
f the European Communi-
e one economic market in

nual meeting of the In-
Biotechnology Association,
s held last week in Coro-
if., discussed the opportu-
d obstacles for smaller
king to the European mar-
general consensus was
outlook is bright.

major multinational bio-
companies have long rec-
the importance of the Eu-
market, with its 320 million
rs and annual pharmaceu-
s of more than $34 billion.
r of large U.S. firms have
ns there, either through
ies or joint ventures with
n companies.

en A. Duzan, chairman and
cutive officer of Immunex
Seattle, said his company
s a profitable joint ven-
h a West German partner.
ses smaller biochemical
go the joint venture route.

1992

The European Community

The first of a weekly Monday feature summarizing the past week's actions and/or statements from the European Community relating to its preparations for a single market by 1992 appears today. The column also will list any action scheduled to take place in the current week.

EC 1992 Roundup, Page 5A

"I see more joint ventures and the exchange of research information and products across the ocean in the future," he told the conference.

Mr. Duzan said there is a certain urgency for companies planning to establish a presence in Europe because of the pending harmonization of the European Community in 1992. At that time, national trade barriers are supposed to come down, and the 12-member community will be a single market with no internal tariffs.

Many questions on the structure of the unified European market remain unanswered, but speakers at the IBA conference agreed that firms that establish a presence there now will protect themselves in the event that limitations are placed upon the entry of new companies after 1992.

Biochemical firms would be logical targets of such restrictions. Europeans have a love-hate relationship with the biochemical industry. On the one hand, they appreciate the efficiency of the industry, particularly in its ability to develop new products.

On the other hand, they are concerned about safety and the environmental impact of the biochemical industry. Groups such as West Germany's Green Party have been effective in promoting legislation to restrict activities of the biochemical industry.

Therefore, companies that plan

SEE US FIRMS, PAGE 13A

US to Set Standards For Exports to LDCs

By WELLINGTON CHU
Journal of Commerce Staff

NEW YORK — Lack of adequate U.S. government support in promoting product standards in developing countries is hurting U.S. exporters, according to a Washington-based umbrella group for U.S. manufacturers.

Under a measure signed into law last week, the government will begin a pilot program to deal with this, using funds raised from manufacturers and exporters.

The U.S. government has received requests from Saudi Arabia, Brazil, China and other nations to help them develop technical product standards, said Patricia Morgan, associate director of international trade for the National Association of Manufacturers.

However, Washington has failed to establish any permanent advisory relationship with these nations, she said. That failure is causing U.S. exports to be shut out of these markets, she warned.

In contrast, some European nations and Japan have set up permanent offices in less developed countries following requests for assistance in drafting product standards.

President Reagan last week signed into law the National Bureau Authorization Act, containing an amendment mandating a pilot program using private-sector donations to assist other countries in the development of domestic standards that are compatible with standards in general use in the United States.

Saudi Arabia is considered a prime candidate for this program.

Congressman Mervyn Dymally, D-Calif., who originally proposed the amendment, is "concerned that our competitors may supply the Saudis with technical information that will bias the standards in use with U.S. products," said Marwarn Burgan, legislative director.

Last fall, the Saudi Arabian Standards Organization, or SASO, asked Commerce to provide funding for a U.S. expert to be assigned to SASO. By 1988, SASO had established more than 400 mandatory standards, but has identified 42,000 more to be set.

Once these standards are in place, commodities and goods that do not conform cannot enter the country.

"U.S. businessmen in Saudi Ara-

SEE US TO SET, PAGE 3A

THE JOURNAL OF COMMERCE, Monday, October 31, 1988

US to Set Standards For Exports to LDCs

CONTINUED FROM PAGE 1A

bia have been pressing for help on this for some time", said Ms. Morgan.

The U.S. government declined.

"Within our limited budget, there is no way to have a permanent staff with SASO," said Walter Light, assistant associate director for industry and standards at the National Institute of Standards and Technology, in Gaithersburg, Md.

The government institute was formerly known as the National Bureau of Standards.

"Congress has deliberately not appropriated money for it now," Mr. Light said.

A likely response to the Saudis, Mr. Light said, is a quasi-government effort where private business will select an experienced individual who will be "indoctrinated" in Gaithersburg, then shipped to Saudi Arabia.

Gilbert Dwyer, president of the American/Saudi Roundtable, a New York-based group of U.S. companies with business in Saudi Arabia, is mulling over the idea of asking Roundtable members to help sponsor an individual to work with SASO. Preliminary cost estimates to send an American to the region are around $225,000, he said.

However, he said, the Roundtable will commit itself only if Commerce Secretary C. William Verity makes a formal request to the group, if a majority of the group supports the idea, and if the individual has quasi-government status.

Mr. Dwyer stressed the importance of some action on the U.S. part since present SASO standards have in effect inhibited some U.S. exports to Saudi Arabia.

A response from Washington is even more urgent, U.S. manufacturers say, since SASO is developing import standards for the Gulf Cooperation Council, which comprises Saudi Arabia, Kuwait, Oman, Bahrain, Qatar and the United Arab Emirates.

Last year council nations purchased about $5 billion worth of U.S. goods, according to the Commerce Department.

According to Mr. Burgan, legislative director for Rep. Dymally, there is "concern that the English, French, Italians and Japanese have been providing technical assistance on a government-to-government basis free of charge."

The manufacturers association contends the Dymally amendment is only a short-term solution to a broader problem. Whatever the cost, Ms. Morgan argued, the U.S. government must assist exporters at this most basic level, in keeping with its policy to promote exports.

A U.S. "product must be compatible" with the standards of the country to which it is being exported, she said.

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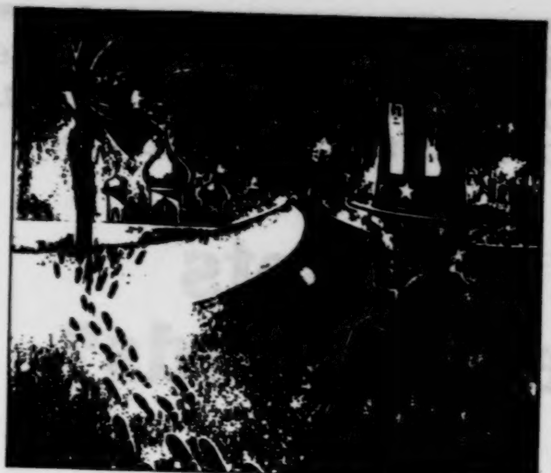
Wonder why we have this gaping balance-of-trade deficit? There are lots of reasons, but here's one that most folks overlook.

Who sets the standards?

By John R. Hayes

GENERAL ELECTRIC's business in Saudi Arabia has been threatened since early last year, when a container of gas turbine parts was held at the port of Dammam. The hang-up? One oil heater didn't conform to new Saudi electrical standards. Customs officials have also stopped shipments of goods from Clorox and Westinghouse. Eventually storage and shipping penalties caused so much screaming and arm-waving that the Saudis declared a moratorium on enforcing their new rules, but product standards remain a threat to U.S. exporters.

Were GE and Clorox shipping shoddy goods to Saudi Arabia? No such thing. Product standards deal not so much with quality but with uniformi-



ty in size, materials and performance. So what happened?

Simply, the U.S. companies let themselves be outflanked. Japan, the U.K., Germany and France have sent teams of standards professionals to Riyadh to advise the Saudi Arabian Standards Organization (SASO) on its 16-year-old project to develop product standards. SASO expects to write 42,000 standards, covering everything from the shelf life of lamb to the color of ground wires in air conditioners. Not surprisingly, our competitors argue for standards that favor their own manufacturers.

A U.S. representative could argue differently, but there isn't one around. Every six months or so the Saudis renew an invitation to the U.S. government to send a U.S. standards expert to Riyadh. SASO even offered to pick up housing, office and local transportation expenses if the Commerce Department would recruit someone. Overruling his staff, former Secretary William Verity, citing the expense, passed up the invitation once again last spring.

Much is at stake. The U.S. used to dominate trade with Saudi Arabia. But since 1982 U.S. exports have slipped from 21% to 15% of total Saudi imports. Today Japan has the biggest piece of the market.

Since other countries in the Persian Gulf—Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates, all members of the Gulf Cooperation Council—will adopt Saudi standards as they are written, an additional $1.5 billion of U.S. exports is at risk.

The Persian Gulf isn't the only area of the world where product standards have trade implications, or where the U.S.' competitors have been quick to react. Consider Brazil, for example, which imports some $17 billion worth of goods. The library at the national standards clearinghouse contains about 70 shelf-feet of German product standards, *in Portuguese*. A gift from a German construction company, these volumes have become the principal reference for standards development in Brazil. U.S. standards are represented by one shelf of 5-to-20-year-old copies of assorted trade association publications.

In India, where $40 billion will be spent on telecommunications equipment in the next decade, Europeans have spent over $16 million equipping a laboratory outside New Delhi to certify that locally made electronic components meet European specifications. The thinking: If India can sell components to Europe for use in European-built transponders, satellites and computers, it will earn the hard currency it needs to buy the finished products from Europe.

Japan's Ministry of International Trade & Industry currently has technical experts working abroad on five nations' standards programs. MITI has also brought standards personnel from 28 developing countries back to Japan, expenses paid, for language and technical training.

Why can't the U.S. counter the influence of the Japanese and the Germans? There is no central clearinghouse for product standards in the U.S. as there is in most other countries. The government is not involved. Instead, some 400 private and public groups develop standards for the various industries. And these groups haven't shown much interest in foreign standards.

So far the lone effort to protect trade with Saudi Arabia comes from legislation introduced by Congressman Mervyn Dymally (D-Calif.). The law, enacted last fall, directs Commerce to accept the Saudi invitation—and similar invitations from other trading partners—but to get the funding from private business.

That may prove more easily said than done. A group called the American/Saudi Roundtable is heading the fundraising effort, but things are not going well. Seems that the Roundtable's letters keep getting forwarded to the Corporate Philanthropy Office. So far the outfit has collected two sincere letters of support, from the U.S. Chamber of Commerce and the National Association of Manufacturers, but only about $85,000 in hard cash. That's one-third of what's needed to fund U.S. involvement for one year. A similar effort by German industry raised $5 million in 20 days.

Old habits die hard. For generations, U.S. business had its own huge market to sell to and simply didn't think much about exporting. Listen to Robert Toth, an American standards consultant to the World Bank: "American exporters still have a take-it-or-leave-it approach to their products," he says. "They say, 'We produced it to the UL standard. If it's good enough for the U.S., it's good enough for you.' " Faced with that attitude, a lot of foreign buyers are leaving U.S. goods alone. ■

I

101st CONGRESS
1st Session

H. R. 2468

To authorize the appropriation of funds for a pilot program to assist other countries in the development of their domestic industrial standards.

IN THE HOUSE OF REPRESENTATIVES

May 24, 1989

Mr. Dymally introduced the following bill; which was referred to the Committee on Science, Space, and Technology

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A BILL

To authorize the appropriation of funds for a pilot program to assist other countries in the development of their domestic industrial standards.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, **That there are authorized to be appropriated to the Secretary of Commerce for each of the fiscal years 1990, 1991, and 1992, $200,000, for the establishment of a pilot program, under section 112 of the National Institute of Standards and Technology Authorization Act for Fiscal Year 1989, to assist in the development of comprehensive industrial standards for a country or countries that have requested such assistance from the United States and will require the continuous pres-**

ence of United States personnel for a period of 2 or more years to provide such assistance.

O

Mr. Walgren. Thank you very much, Congressman Dymally.

I'd like to enter in the record at this point a letter to the Subcommittee from the American/Saudi Roundtable, dated July 20, 1989, in which they make some of the same points that you have in your testimony, and underscore the fact that although they have taken up as a private sector group on an ad hoc basis the provision of some—or at least the raising of money and now the hoped for sending of some representation to that particular country, they make the point that an ad hoc effort focused on any one region or any one problem really does not cover the national interest, and only the Department of Commerce is positioned to reflect the interests of the full spectrum of American industries. They also note the number of requests that we have received from other countries to which we have not responded and express and underscore the importance of the Department of Commerce developing this role.

[The letter follows:]

American / Saudi Roundtable 25 Smith St., Nanuet, NY 10954 914-624-2090 Telex: 882603 Fax: 914-624-2094

July 20, 1989

An association
of United States
companies with
business interests
in Saudi Arabia

Hon. Robert G. Neumann
Chairman
202-775-3125

Gilbert E. Dwyer
President
212-751-4591

Hon. John C. West
Chairman Emeritus
803-785-4300

**Hon. Doug Walgren, Chairman,
Subcommittee on Science, Research and Technology
2241 Rayburn House Office Building
Washington, D.C., 20515-3818**

RE: International Product Standards

Dear Congressman Walgren:

Anticipating the Subcommittee's hearing on the subject of international product standards, the membership of the American/Saudi Roundtable believes it appropriate and timely to share our concerns with you and your Subcommittee colleagues.

The American/Saudi Roundtable is an association of major U.S. companies with significant and long-established business interests in Saudi Arabia. Since our formation in 1981, the Roundtable has worked to enhance business relations between the U.S. and Saudi Arabia. Our member companies represent a wide range of American industries, including the electrical, aircraft, petroleum, food processing, hotel, and financial services businesses. A list of our members is attached.

Our concerns for international product standards are twofold:

- **The impact of national or regional technical products standards on United States trade, particularly with Saudi Arabia and the other Gulf**

Cooperation Council (GCC) countries;

- The encouragement of national and regional standards that serve the best interests of the United States and the nations that represent markets for American products.

The Subcommittee will be presented with substantial evidence of the damage adverse standards can do to American trade opportunities. We are already measuring them in Saudi Arabia where standards have served to exclude United States products, require their modification, or otherwise erode our competitiveness.

There are no real villains in this scenario. Competing nations cannot be faulted for trying to increase their competitive edge. Certainly the Saudi government can't be blamed for accepting what willing help is offered. The damage America is sustaining is the result of our failure to compete.

More than ten years ago the government of Saudi Arabia asked for standard-setting advice from all of its major trading partners. Other countries were quick to respond with assistance, most notably Japan which has supplied six to nine specialists constantly for several years. But, despite a positive recommendation from a National Bureau of Standards (now the National Institute for Standards and Technology, NIST), team which visited Riyadh, the United States still has not responded. With the United States not participating, the field was abandoned to standards advisers from competing nations. Our competitors have supported standards favorable to their countries' products and inimical to ours.

Responding to the November 10, 1988 request of then U.S. Secretary of Commerce William C. Verity, the Roundtable has accepted the leadership of a U.S. private sector effort to establish in Saudi Arabia an American standards expert to assist in the development of technical product standards for Saudi Arabia and the GCC countries.

While the former Commerce Secretary's request triggered this Roundtable undertaking, the blueprint was provided by Congressman Mervyn Dymally who proposed an amendment in September 1988 to the NIST funds authorization bill. Citing the persistent problem of the national trade imbalance, Congressman Dymally proposed and the Congress authorized a pilot program under which NIST is directed, using private sector donations, to assist other countries in the development of domestic standards compatible with United States standards.

The Roundtable accepted the leadership role in launching such a pilot program in Saudi Arabia because of the importance of the matter both to U.S. exporters (including some but not all of our members) and to Saudi Arabia and because it was the only available answer to a pressing problem.

Over the last eight months we have conducted a campaign to raise the necessary funds from American companies interested in the Middle East. With the required funds contributed or committed, we are now setting up a panel of United States standards experts to provide overall guidance to the program. Soon we will select and hire a standards expert who will be the United States representative to the Saudi Arabian standard-setting organization.

We believe this pilot program in Saudi Arabia will be successful on an interim basis. But we see it as a stop-gap measure.

Any ad hoc effort focused on a particular country or region and sponsored only by companies directly interested in that country or region entails obvious disadvantages:

- it concentrates the cost on a few interested companies rather than spreading it over all who will benefit;

- it imposes disproportionate responsibility on companies dealing with developing countries which have not yet become broad-based export markets;

- and it risks disproportionate influence on the process by major private sector contributors.

While we are confident of positive short-term results from the pilot program, we are convinced that the only way to assure a proper national approach to the matter of international standards with the requisite continuity, consistency, organization and objectivity is to assign responsibility for its leadership and direction to the Department of Commerce and to authorized the funds the Department will need to carry out the responsibility.

The Department is positioned to reflect the interests of the full spectrum of American industries and has the capacity to enlist the specialized skills of the existing trade associations and standard-setting panels. And NIST can serve as a cadre of technical skills and a clearinghouse for information.

The challenge of international standards is growing. The experience in Saudi Arabia is a harbinger. The challenge is evident in the complex blossoming of the European market. It is evident in the requests for standards development help that

the United States has received from Brazil, India, and the People's Republic of China. The United States has a role to play. And the economic and political costs of remaining a spectator could prove to be very, very high.

We hope that, after conducting its hearing, the Subcommittee will take an early initiative in defining and authorizing this new, important role for the Department of Commerce. The Roundtable pledges its assistance, and the benefit of its experience, in this important initiative.

Sincerely yours,

Gilbert E. Dwyer
President

cc: Members of the Subcommittee
Hon. Mervyn Dymally

American/Saudi Roundtable

Membership of the American/Saudi Roundtable

(Members of the Roundtable are chief executive officers or senior line executives of the following companies:)

American International Underwriters
AT&T
Bechtel Civil
Citicorp/Citibank
Deloitte, Haskins & Sells
Exxon
Fluor Daniel
General Electric
HCA International
M.W. Kellogg
Marriott Hotels
McDonnell Douglas Services
Mobil Oil
Price Waterhouse
Shell Oil
Texaco
Textron
Vinnell
Waste Management
Westinghouse Electric

COMMITTEE ON
SCIENCE, SPACE & TECHNOLOGY

COMMITTEE ON
FOREIGN AFFAIRS

HOWARD WOLPE
THIRD DISTRICT, MICHIGAN

Congreſs of the United States
House of Representatives
Washington, DC 20515

July 27, 1989

Dear Colleague,

I will be offering an amendment to the NIST Reauthorization bill, along with my colleagues George Brown and Claudine Schneider, that authorizes an annual appropriation of $250,000 to the Secretary of Commerce in fiscal years 1990, 1991 and 1992 to establish a pilot project to assist countries in the development of domestic product standards. Such assistance ensures that countries do not develop standards that serve as barriers to U.S. goods and services.

The pilot program would provide assistance to a country or countries that have requested such assistance from the United States. My amendment requires the private sector to provide matching funds for this program. There is a history to this issue which I would like to explain briefly. While no funds were appropriated, P.L. 100-519 directed the Department of Commerce to set up a pilot program and within six months receive reimbursements from the private sector. To date, the private sector has raised approximately $180,000 -- short of the estimated $250,000 needed -- to establish a program and to send one standards specialist overseas.

Several developing countries have asked for U.S. assistance to develop standards, including Brazil, India, Israel, Saudi Arabia, Peru, Jamaica, Turkey, and Malaysia. According to NIST officials, most of these requests were made informally, because officials from these countries knew that formal requests would be turned down for lack of federal resources. In many instances, the U.S. government has provided spot or short-term assistance to these countries, oftentimes joining an industry effort underway. If the proposed pilot program is established and funded, many other trading partners are likely to request U.S. assistance.

Standards development assistance is a legitimate role of the federal government. Several of our major trading partners, including Canada, West Germany, Great Britain, France and Japan aggressively pursue opportunities to provide developing countries with technical expertise to develop product standards. Such activities make good, strategic marketing sense, ensuring that the recipient countries establish standards that are compatible with their own standards, thereby preserving markets as well as promoting increased exports.

Saudi Arabia provides the United States with an immediate opportunity to lend product standards assistance. During the past several years, the Saudi Arabia Standards Organization (SASO) repeatedly asked the Department of Commerce to send a standards specialist to develop a standards code which will affect over 42,000 products. The five other member states of the Gulf Cooperation Council -- Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates -- intend to adopt the Saudi code. Together these countries accounted for $5.7 billion in U.S. exports in 1988.

Sincerely,

Howard Wolpe

Howard Wolpe
Member of Congress

Mr. **Walgren**. So I hope that because of your efforts and because of the attention that we may be able to give this as a committee in our authorization process, and because of the good sense it makes, that the Department of Commerce will be running with us in establishing that kind of presence abroad.

Mr. **Dymally**. Thank you, Mr. Chairman.

Mr. **Walgren**. Are there any other Members who would like to raise points with Congressman Dymally before he leaves?

If not, we thank you for coming, and we will see you soon.

At this point, we are going to suspend our hearing and have a discussion with Mr. Woods, the Director of the Canadian organization involved in standards, and we will ask Mr. Woods if he might come forward to the table. We really do appreciate your coming and realize that there are some formal limitations on the kinds of formal testimony that can be given to bodies of the United States Congress by representatives of foreign governments, and that is why we doubly appreciate your being willing to come and talk with us about your experience in standard setting and the role that the standards play in facilitating trade and fair access on both sides of the question for all the partners involved. We would be pleased to listen to any experience that you could share with us so that we can have the benefit of that wisdom as well.

Mr. Woods.

STATEMENT OF JOHN R. WOODS, EXECUTIVE DIRECTOR, STANDARDS COUNCIL OF CANADA

Mr. **Woods**. Thank you very much, Mr. Chairman.

At the outset, I would be very appreciative if the chair could recognize our president, Mr. George Archer of the Standards Council of Canada who is sitting behind me.

Mr. **Walgren**. We are glad you are here. Welcome, Mr. Archer. Thank you for coming.

Mr. **Woods**. I would like to say that it is a distinct honor to be asked to appear before this very prestigious committee, and I hope to share with you some of the reasons for the creation of the Standards Council and what we do today.

The Council was formed by an act of Parliament in 1971, the reason for this being that some senior bureaucrats, or mandarins, felt that the standards process was fragmented in Canada at the time—this would be 1970/71—and that a body should be set up to try and coordinate the standards efforts in the country. We are a large country with a small population, and this became very important because the number of people involved in standards generally were very few.

The Council was then put into being, and it consists of 57 members. Now we have 41 members from the private sector, we have 10 members from each of our 10 provinces, and we have six members from the Federal Government. They sit, and the president controls the Council.

This is a large Council, and from time to time it has been criticized, but I have to say that I believe in its strength of numbers because you get a representation from many private sector bodies which are vitally interested in standards, so they have a place and a forum, and they belong to the Council, and they can make their views known, and I think this is very important.

I would like for a moment to outline to you what has happened, what the situation was before Council and what it is now. Prior to the formation of the Council, the Canadian Standards Association, CSA, looked after Canada's role internationally. Clearly, their resources only allowed them to go so far, and this was one of the reasons for the formation of the Council.

Before I go any further, I'm sorry, I should say that the Council was formed as a Crown corporation. A Crown corporation means that the corporation is distinct and apart from government. However, its only shareholder is the Federal Government, but we have two very important exemptions under the Financial Administration Act. One is, the Government cannot direct us on how to spend our funds, nor can they direct us on how to conduct standardization activities. So we are very independent, or we feel we are.

My employees are not servants of Her Majesty under the act, so they are not civil servants, and we are truly a Crown corporation. I think another illustration of one would be Air Canada which, until recently, was a Crown corporation.

Prior to the formation of the Council, the Canadian Standards Association represented Canada on approximately 30 percent of the ISO and IEC committees. To date, we are represented on 80 percent. As well, the president of ISO is a Canadian, the vice president is IEC is a Canadian, and we have one board member on ISO.

At the time of the formation of the Council, there was no vehicle to produce national standards of Canada. The Council took this on, and we now have 1,400 national standards of Canada which represent approximately 27 percent of the standards current extant in Canada.

The consumer was not well represented prior to our formation. Now, however, they have an advisory committee to Council, and as well we take a very active role in ISO CAPULCO Committee, the consumers' committee.

A sales department was set up in Council to sell only foreign standards, and last year our sales were over $1 million Canadian, which we feel is very satisfactory. Those are only international standards that are sold, foreign standards.

We have an information section, and industry and government are free to call this line, and we have currently over 400,000 up to date standards, regulations, and codes which may be drawn upon by the—particularly the private sector at no change.

As well, we run the GATT inquiry point for the Department of External Affairs who pay us to perform this service.

I think one of the main things we do and one of the things which has added a great deal to the credibility of Council is our accreditation programs, not only for standards writing organizations but for labs and certification organizations. We now have all the major standards writing organizations accredited, a great majority of the certification organizations, and some 60 labs, with another 55 in the pipeline.

I should say also, Mr. Chairman, that we are very fortunate in having the services of between 3,000 and 8,000 Canadian volunteers

who sit on our various committees and represent Canada internationally.

That is the Council as I see it. This is the way we are set up. It is a unique way. I think I should say in all fairness that when the Council was formed and during its formative stages in the House there was some resistance to it—in fact, a good deal of resistance—and there was heavy lobbying against it. The fear, I think, was generated that the Council would somehow usurp or take over the duties of the private sector standards writing organizations, and it took a number of years to allay these fears, and I am very happy to say that at this point in time these organizations are a very vital part of our committees, the presidents of the organizations chair our committees, and they are 100 percent behind the Council. So it is working.

I think the other thing I should say is that when we came in—and I neglected to say this—when we came into being, one of the things we wanted to do was set up a plan of subject areas for standards writing, because we found that there could be as many as three standards organizations all writing the same standard. So we sat down and said, "Look, we've got to all agree that you will write fire standards and somebody else will write sheets and blankets and somebody else will do x, y, and z," and this has worked out surprisingly well.

When there is a contretemps or there is a disagreement, we simply say, "Look, you people, you are the system; sit down and sort it out between you, and then come back and tell us who is going to do it." So it works very well.

Mr. Chairman, I don't think I can add much more to my little outline of our Council, but I would certainly be pleased to accept any questions and do my best to answer them.

[The prepared statement of Mr. Woods follows:]

OUTLINE of REMARKS by JOHN R. WOODS
EXECUTIVE DIRECTOR, STANDARDS COUNCIL OF CANADA
to the U.S. CONGRESS COMMITTEE on
SCIENCE, SPACE and TECHNOLOGY
WASHINGTON, D.C. JULY 25, 1989

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1. OBJECTS AND POWERS of the STANDARDS COUNCIL OF CANADA

The Standards Council of Canada was created in 1971 by the Parliament of Canada. A Crown corporation funded by parliamentary appropriation, the Council is "not an agent of Her Majesty", and is exempt from government directive in the pursuance of its work. As stated in the Standards Council of Canada Act, the Council's overall mandate is:

> *"...to foster and promote voluntary standardization in fields (...) not expressly provided for by law, as a means of advancing the national economy, benefiting the health, safety and welfare of the public, assisting and protecting consumers, facilitating domestic and international trade and furthering international cooperation in the field of standards."*

The Council is the Canadian member of ISO and IEC, and is empowered to accredit standards-writing, testing and certification organizations, and to approve national standards.

With a staff of 69, its current budget is nine million dollars.

2. ORGANIZATION of STANDARDIZATION in CANADA

Before the establishment of the Standards Council, the Canadian standards effort was at best uncoordinated. Governments, as well as trade and business associations, were both involved in writing standards, often with little input from significant concerned groups such as consumers. One such private organization, the Canadian Standards Association (CSA), was then representing Canada on some 35 per cent of ISO and IEC technical committees -- committees in which CSA was itself active nationally.

Since the inception of the Standards Council, legitimate Canadian organizations involved in standards writing, testing and certification have been grouped in a national federation, the National Standards System. The System, which also includes two Canadian National Committees on ISO and IEC, now comprises five standards-writing organizations, six certification organizations and more than 50 testing laboratories, all accredited by the Standards Council. A formal category of National Standards of Canada has been established, with more than 1200 Canadian standards approved by Council so far.

The Council itself is a forum made up of a maximum of 57 members: six representing the federal government; 10 representing the provinces and up to 41 others representing private interests nationwide. Several advisory committee help ensure that the Council benefits from the opinions and advice of specialists in specific areas. Current advisory committees are responsible for advising Council on questions such as:

- Standards for consumers;
- Standards information services;
- Accreditation of certification and testing organizations;
- Coordination of standards work within the National Standards System;
- International standardization.

With only 10 per cent of the United States' population -- and, accordingly, much fewer standards experts -- Canada now offers a strong representation on over 80 per cent of all ISO and IEC technical committees, and holds more than 100 international secretariats and convenorships. Currently, nearly 1,000 Canadian experts attend some 200 working meetings of ISO and IEC annually. The fact that two Canadians are now President of ISO and Vice-president of IEC reflects Canada's current prominence on the international standards scene.

3- SERVICES of the STANDARDS COUNCIL

ACCREDITATION SERVICES

One of the main thrusts of all Council activities is to ensure that Canada's needs are met in the areas of standards-writing, certification and testing. To this end, it operates an accreditation program in each of these areas.

With the Free Trade Agreement, U.S. testing and certification organizations can now apply for Council accreditation.

STANDARDS INFORMATION SERVICE

The Standards Council's library of more than 400,000 Canadian, international and foreign standards publications, available for public reference, provides the basis of a national standards information service. Staffed with professionals, the service answers questions regarding standards, technical regulations and certification systems. Some 700 enquiries are answered each month.

GATT ENQUIRY POINT

Under contract with the federal department of External Affairs, the Council also acts as the Canadian GATT Enquiry Point. As such, it notifies the GATT Secretariat of proposed changes to mandatory Canadian standards, technical regulations and certification systems, and receives information on proposed changes from other countries.

STANDARDS SALES

The Council also offers a central service for purchasing ISO and IEC international standards, as well as the national standards of some 90 countries, including the United States. Sales last year amounted to about one million dollars.

PUBLICATIONS & AUDIO-VISUAL

The Standards Council offers business, technical and general audiences a number of print and audio-visual documents dealing with various aspects of its programs and on standardization in general. CONSENSUS, its quarterly periodical, reaches some 14,000 readers involved with either the preparation or the use of standards. Numerous 30- and 60-second public service announcements, broadcast free of charge by TV stations, have helped Canadians better understand the importance and effects of standardization.

4- STANDARDS ASSISTANCE TO DEVELOPING COUNTRIES

Since 1982, the Standards Council has played an increasing role in administering technical assistance programs for developing countries. With financial support from the Canadian International Development Agency (CIDA) the Council is or has been involved in providing technical assistance to Belize, Brazil, Indonesia, Kenya, Malawi, Malaysia, the People's Republic of China, the Philippines, Senegal, Singapore, Sri Lanka and Thailand.

Such assistance includes the collaboration of appropriate Canadian organizations; the provision of documentation; and the organization of training seminars, either in Canada or on site, whenever conditions permit. Aside from CIDA funding, these programs rely heavily on the expertise and facilities of other members of the National Standards System, particularly its standards-writing and certification components.

Requests for assistance are either made directly to the Standards Council, or through the United Nations Industrial Development Organization (UNIDO).

Mr. **Walgren**. Thank you very much, Mr. Woods. We appreciate that.

Maybe it is natural, but everybody sort of feels that their neighbor or their competitor might have gotten ahead of them, and we kind of have that feeling a little bit here with your movement to this Council, at least compared to our own standards organizations as I understand them.

Are there ways that you could measure how things are working better? You indicate that your participation in international organizations has gone up substantially, from 30 percent to 80 percent. Are there any other ways that strike you that would—you would look back and say, "Gee, this system is working better internationally for us than we were before"?

Mr. **Woods**. Well, one of the things we do—and that's a very good question, Mr. Chairman—one of the things we do is, we fund delegates and secretaries to offshore meetings, and we find this is vital, it's absolutely vital. We don't fund them entirely, but we provide their full economy air fare so they can go, and usually their companies pick up the—well, always they pick up the balance.

But this gives them the opportunity to go down and represent Canada in areas that we weren't before, and, as an illustration, we sent a sizable group to Brazil at one point, three years ago, and that led to a delegation going down, two experts, and we redid the Brazilian fire code for them.

So, you know, it's often been said that the European especially will write standards with you or without you. So our feeling is, we have to be there, we have to be vigilant, we have to be taking part, we have to try and influence the outcome of the final standard, and I might say that—at this point I would like to say that we have enjoyed an extremely close relationship with ANSI, both with the former president, Mr. Donald Peyton, and the present one, Mr. Manuel Peralta, and we try and, as best we can, coordinate our positions in the international forum.

Mr. **Walgren**. Being there is certainly important, and I gather that before 1970 there obviously were areas that you weren't and that Canada's representatives were not there. Now why does this structure bring you to be there where the former voluntary industry, totally private sector, I gather, organization would not have been there? Is there some just basic structural focus that—

Mr. **Woods**. I think it's quite simple, really. We are in a position to provide (a) secretariats for international technical committees; we can take on that responsibility, which is a financial one as well as a resource; we can take that on. Secondly, as I mentioned before, we are in a position to fund, or partially fund, delegates to these meetings.

Mr. **Walgren**. Because of access to Government monies that would not instinctively come from just a group of domestic business concerns.

Mr. **Woods**. This is right.

Mr. **Walgren**. I see.

Do we have any parallels to this Crown corporation that apparently receives Government monies but is not subject to Government control and whose people are not civil servants?

Mr. Woods. I may be pleading ignorance, Mr. Chairman, but I have no knowledge of that. I don't believe so.

Mr. Walgren. I see.

Well, let me turn to some of the other Members for thoughts they might like to raise and recognize the gentleman from Alabama, Mr. Browder.

Mr. Browder. Thank you, Mr. Chairman.

Mr. Woods, apparently, according to the information we have, the United States is not a player in this area, and you have implied that with your last statement. How much of a problem is this for us, and is it too late for us to become a player?

Mr. Woods. Mr. Browder, I don't want to be misunderstood. I didn't say the United States or, indeed, ANSI was not a player. In my view, ANSI has taken on internationally probably more than their fair share since I have been with Council, and that is seven years.

As to the support, the Government support, et cetera, I really don't feel I can comment on that. I just have to tell you the way the situation is in Canada, but make no mistake, ANSI, for instance, has the technical committee of ISO which—that technical committee alone is bigger than all the technical committees of ISO, and it is an American responsibility, and they do it very well indeed.

Mr. Browder. Let me follow that up with one question. How is Canada responding to Europe '92 with respect to standards and certification, and what has been the response from Europe '92?

Mr. Woods. Well, I think, as you mentioned, there are two parts to this; one is standards; one is certification. At the present time, our posture, if you like, is one of vigilance and—well, let's say positive vigilance. We hope that we are coming into a situation where, instead of having to abide by the rules of 14 countries there will be only one set of standards, et cetera, et cetera, to meet.

The problem here—and I am on the board of ISO, and we have been monitoring how they are doing with ISO and IEC standards, both CEN and CENELEC, but I think the real problem here is, what we don't know is what their testing requirements are going to be or what their certification requirements are going to be.

You could have the situation where they might adopt, say, an international standards organization standard in total, but then they may do something in the product standard vis-a-vis the testing requirements which are different than perhaps or amended from the original. These are things we don't know. So we are watching very carefully. We are very fortunate that our Government has an office in Brussels specifically to monitor 1992, and they are very good about getting to me within, say, 48 hours of something happening.

So, really, it's more than a watching brief, but that's the best way I could put it.

Mr. Browder. But you don't have any sense of the response that Europe '92 has to your initiatives on this?

Mr. Woods. No. I think—

Mr. Browder. It's too early?

Mr. Woods. It's a little early.

Mr. Browder. Thank you, Mr. Woods and Mr. Chairman.

Mr. **Walgren**. Thank you, Mr. Browder.

Mrs. Morella.

Mrs. **Morella**. Thank you.

I am pleased to welcome our neighbor to the north and hear about the Council that has been established.

Mr. **Woods**. Thank you.

Mrs. **Morella**. I'm curious about the specifics of the funding. Does the private sector put some money toward it? Do you have to lobby to get the money put into the budget? How do you work that out? Is it totally governmentally funded?

Mr. **Woods**. Our funding is approximately—well, it's nine and a half million dollars a year. It is negotiated with the Treasury Board once a year in the Fall, and it forms—our grant from the Government forms about 92 percent of our revenue. I think we probably go through the normal routine of any corporation getting money from a government where we are in a negotiation process, but I think the word "lobby" in its true sense, no, we don't lobby.

Mrs. **Morella**. Do you have accountability in terms of submitting reports to Parliament?

Mr. **Woods**. Yes, we have to submit our report. We have to be audited by the auditor general, and then we submit our financial reports through the Minister of Consumer and Corporate Affairs to Parliament.

Mrs. **Morella**. And is the authority statutory? Is it simply accepted in terms of policy? Is it regulatory?

Mr. **Woods**. The Council has no regulatory powers at all, so I must stress that the national standards system which makes up all our accredited organizations is a voluntary consensus set-up. We have no regulatory powers at all. In other words, a part of the system or a company could pull out, and that would be the end of it. So it is truly voluntary consensus.

Mrs. **Morella**. The people on the Council serve for a period, a designated period of time?

Mr. **Woods**. Serve?

Mrs. **Morella**. Right, on the Council.

Mr. **Woods**. Yes.

Mrs. **Morella**. I mean is it like two years, four years, or how—

Mr. **Woods**. We have a number of Council committees, and they serve on these committees, anywhere from one- to three-year terms.

Mrs. **Morella**. Also, who selects these, let's say, 41 people, is it, from the private sector?

Mr. **Woods**. Well, the organizations will write our president, Mr. Archer, and suggest a name, and if he approves it he will forward it to the minister, and then it is up to the minister to make it formal and legal and inform the individual that they, indeed, have been nominated to the Standards Council of Canada.

Mrs. **Morella**. But somebody will have to be leading or have a term that expires, right?

Mr. **Woods**. Yes.

Mrs. **Morella**. Unless you want to just keep expanding.

Mr. **Woods**. This is right. It keeps turning over.

Mrs. **Morella**. So it does keep turning over?

Mr. **Woods**. But we have the option of renominating them.

Mrs. **Morella**. If you were asked what you would do to make it work more effectively, would there be a recommendation that you would offer?

Mr. **Woods**. Well, you know, the first one is, I'd like to have more money.

Mrs. **Morella**. That's an international refrain.

Mr. **Woods**. But I'm ever optimistic.

No, I don't think so. If I may, I think we have a remarkable system, and it's working, and it's working very well. But, bear in mind, we are a small country, and it is working well. I'm delighted with it.

There have been suggestions in the past that we should—from Members of Parliament—that we should have a more regulatory type of organization, and my president and I both agree that this is not on. I mean it would spoil entirely the character.

We have built up credibility, we really have, and now it's starting to pay off; everybody is pulling together.

Mrs. **Morella**. It's good to hear such positive comments.

I thank you, Mr. Chairman.

Mr. **Walgren**. Thank you, Mrs. Morella.

Mr. Brown.

Mr. **Brown**. Mr. Woods, this is not a question, but I just would like to get your comment about the U.S. failure to complete a transition to the metric system of weights and measures in this country. In this Committee, particularly, we've been concerned about it for many, many years and have passed legislation which has been intended to move us along, but apparently it hasn't moved us along very rapidly.

I would like to ask you to comment as to whether or not this, in your opinion, is a factor in disadvantaging us with regard to international trade as well as some of these other standards issues that have been pointed out to us here.

Mr. **Woods**. Well, sir, I'd like to say at the outset that when metrification was planned for Canada the Standards Council was asked to take it on, and then it was moved over to Consumer and Corporate Affairs. So we have had a little bit to do with it, certainly in its initial stages.

Whether or not it inhibits the United States trade picture, I can't really comment on that, but I will say that I think in Canada it has been very much of a forward step. The reluctance, as you can well imagine, came not from industry in Canada, it really principally came from the consumer. That now, after several years, has pretty well been put to bed.

So we are in favor of it, very definitely, and it does work, and, you know, it's supposed to be 96 today here in Washington; I'm trying to figure out if that's 32 or 33. But I'm too old to change completely, but I think it does work very well, and my own personal opinion is that, you know, the world is on it, and it's a trading thing, we have to do it.

With all due respect, I think probably there's a great many industries in the United States that are working with metric tools, and metric bolts, and metric this and that; I mean they have to be in the automobile industry, for instance.

Mr. **Brown**. Yes, there are many industries that have moved along voluntarily, but we seem to be kind of stuck on dead center at the present time. The public has not picked this up as well as we would like, and there is still resistance, as a matter of fact.

I guess the problem that we have is whether or not we ought to bring this to a head, as I think you and other countries have, by setting a deadline for conversion, at the end of which time we would be completely converted. We have never wanted to take that step over here.

I have no further questions, Mr. Chairman.

Mr. **Walgren**. Thank you, Mr. Brown.

The gentleman from Michigan, Mr. Wolpe.

Mr. **Wolpe**. I have no questions, Mr. Chairman.

Mr. **Walgren**. The gentleman from North Carolina, Mr. Price.

Mr. **Price**. Thank you, Mr. Chairman.

I'd like to ask you to elaborate a bit on the kind of private sector ties, cooperative arrangements, that you have in Canada. As you know, our system in this country remains voluntary and exclusively a private sector system, and I wonder what kind of participation you get from industry, what kind of relations you have with industry, in the Canadian setting.

How does your Standards Council, for example, decide which international delegations to fund? Do the industries lobby for governmental assistance in that regard? Are there some industries that do not want governmental assistance or governmental funding? Could you elaborate on that a bit further?

Mr. **Woods**. Yes, I'd be pleased to, Mr. Price.

When our committees were set up, we tried to initially set up committees which we knew were of vital interest to Canada, and the industries concerned, for instance, in metals, Noranda and Falconbridge, would contribute not only money but people to the committees, the international committees. So there's no problem when you send these people out of the country to attend meetings, because the company usually picks it up. We still pay a small portion of it.

The committees—and I'd like to stress this—are entirely, virtually entirely, private sector, but they do have Government representatives; those Government people who are interested in that particular committee sit on it, so it gives them an opportunity to take part in the creation of a standard. But the vast majority of the committees are private sector.

Now in Canada there has always been a feeling of wariness when it comes to the Government, and I believe that is true of the United States, and it took us several years to get our message across: "Look, we're not Government; we're here to serve, but we can't serve without your help;" and now these committees are rolling along. They perpetuate themselves; they elect their own people. We have nothing to do that. They elect their chairmen, they elect their members, and they just inform us to please make a note that Mr. Smith has taken over from Mr. Brown. So that works very well. About every two or three years, we sit down with the chairmen, and we go over these committees and see if they are still relevant, whether they should be bigger, or even, indeed, whether they should be cut out.

Mr. PRICE. And the funding, you say—there is some Governmental funding, but it tends to be minimal?

Mr. WOODS. Yes. The Government—our funding is strictly the full economy air fare to where they are going and, in some cases, the hotel.

Mr. PRICE. Otherwise, the expenses of these delegations are picked up by their companies.

Mr. WOODS. Yes. But, as a detail, if you take the full economy air fare and trade it in on a Super Apex fare, you are going to have enough left over for the hotel.

Mr. PRICE. I understand.

Thank you, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. Price.

The gentleman from California, Mr. Campbell.

Mr. CAMPBELL. Thank you, Mr. Chairman, and thank you, Mr. Woods, for that insightful comment on budgetary restraint and reprogramming.

I have two very brief questions. First, there has been concern in the United States of the use of standard setting as a means sometimes of excluding competitors, the prospect that a group of powerful members of an industry will set standards in such a way as to make it difficult for a new entrant or for a disfavored competitor. Could you comment on your experience with that and, in particular, what structural mechanism there is in the Council to have some input from that perspective from your governmental authorities?

Mr. WOODS. Well, Mr. Campbell, when a standard is put forward to us by the standards writing organizations for a national standard of Canada status, there is a rigorous criteria which that standard is going to be subjected to, and one of the criteria is that we make absolutely sure that it will not be in any way construed as a technical barrier to trade or any part of that standard.

As for the ones that aren't national standards of Canada, in my seven years with the Council I have never once had brought to my attention that there was a complaint that a standard, either U.S. or Canadian, was a technical barrier to trade in the serious sense of the word.

Mr. CAMPBELL. Is the Council itself, by law, immune from a liability for restraint of trade?

Mr. WOODS. No.

Mr. CAMPBELL. So that if the Council were to be used in a fashion that did lead to the result which you have not seen in the last seven years, there are mechanisms under which that could be resolved?

Mr. WOODS. Yes. We could be sued, if you like, and because we are a Crown corporation, in the technical, legal sense, the Crown is not obligated to pay our fine.

Mr. CAMPBELL. Well, now I'm stuck. What does that mean?

Mr. WOODS. Well, I'm getting right down to the bare bones here. It could lead on forever and ever.

Mr. CAMPBELL. I appreciate that.

Mr. WOODS. But, in fact, yes, we could be sued, but say the judgment was so enormous that it would seriously impair the Council; the Government would normally step in and pay the fine, stand behind it. But the fact is, they don't have to do that, because we are a Crown.

Mr. CAMPBELL. Understood.

One last question on that. Is there a structural role for your fair trade authorities? It used to be Lawson Hunter ran that when I used to deal with Canadian trading authorities; I don't know if it is any more. Is there a structural mechanism for that agency to take part in the standard setting?

Mr. WOODS. Oh, yes. The standard setting, Mr. Campbell, is wide open, wide open. Anybody that—we have actually put people on committees that have had product problems. We've sent them down and said, "There, you sit on that committee, and try and iron out the problems." They are wide open.

Mr. CAMPBELL. Thank you, Mr. Chairman.

Thank you, Mr. Woods.

Mr. WALGREN. Thank you, Mr. Campbell.

Mr. Skaggs.

Mr. SKAGGS. No questions, thank you, Mr. Chairman.

Mr. WALGREN. One of the thoughts I was having here is that this difference between a quasi-governmental organization which may have a more comprehensive motivation than an assembly of individual private sector firms might have, and looking at Mr. Dymally's testimony, he was saying that with respect to electrical appliances in Saudi Arabia, they are either European, Japanese, or American but foreign-made, and we were wondering why a company perhaps like General Electric, or something like that, which participates in our standards process, might not be directly motivated to participate in these standard-setting groups, and perhaps if they are ready to fill the product orders from their own manufacturing abroad, perhaps they don't have any real interest in that.

Do you have any feel for whether the substantial presence of foreign manufacturing by domestic firms would lessen their interest in the active presence of American-based manufacturing in the standard setting process abroad?

Mr. WOODS. Well, I think that what we are talking about here is perhaps a multi-national manufacturing in, say, Holland and shipping to Saudi. The only way, in our view, that you can bring all these things and coordinate them is to go on international standards, and I believe this is happening more and more.

The electrical industry that you mentioned, Mr. Chairman, is now, to a great extent, going on to International Electro-Technical Commission standards, IEC, both in Canada and the United States, and Canada is very, very enthusiastic about international standards because, as I said, we are a fairly large trading country but with a very small population, and the obvious route for us to go is international standards.

But whether General Electric in the United States or outside of Toronto is working to—I suspect they are working to the standard that is required by the company.

Mr. WALGREN. Well, I'm just wondering whether—what is it that goes to motivate a domestic, in this case, American, standards organization to have presence abroad, as you have found has been helpful to Canada and we see lacking in our own physical representation abroad on a standards basis from the United States perspective, and I wonder what it is that drives that abroad.

You mentioned that there was real resistance to going to a quasi-governmental standards organization from the Canadian voluntary private-sector groups. Looking back on that, why was there so much resistance, and would they themselves now, with their experience, say, "Well, gee, we must have just not been thinking very straight"?

Mr. WOODS. Well, I think, Mr. Chairman, as I mentioned, I think they felt that it was going to be a—the Council would be a threat to them, and this was not the purpose of it at all, and over the past few years the wheel has come full circle, and now they are 110 percent behind the system and the Council because we are all working together, and hopefully we are all marching down the same road together.

Mr. WALGREN. And that was never the case. I mean you never really—there were never any specific plans to operate in a way that would have been a threat.

Mr. WOODS. No.

Mr. WALGREN. And so what you faced was simply the apprehension, unfounded, ungrounded—

Mr. WOODS. That's right.

Mr. WALGREN. —at least ungrounded in fact, and yet that was a substantial controversial and made it controversial to make that.

Mr. WOODS. In fact, the gentleman that drafted our act, as I mentioned earlier, put in two specific items into the Financial Administration Act stating that we didn't have to—nobody could tell us how to spend our money or how to conduct standards activities, and I think this was put in to try to keep them happy.

Mr. WALGREN. I see.

Well, on behalf of the committee, we want to express our real appreciation for your coming, and Mr. Archer as well. We appreciate being able to talk with you and look on you as a real resource for guidance that we might find helpful. We appreciate your being here.

Mr. WOODS. Thank you very much, Mr. Chairman.

Mr. WALGREN. Thank you.

Let's go then to the third panel in the witness list: Manuel Peralta, who is the President of American National Standards Institute; Joseph O'Grady, the President of the American Society for Testing and Materials; and Ms. Helen Wood, President Elect of the IEEE Computer Society.

If you folks would come forward and join us at the witness table, we would appreciate it very much, and, as you know, in our hearing process, your written statements will be incorporated and reproduced in the record in full, and you can feel free to focus or underscore points that you might have made more elaborately or in other ways in your written testimony and in talking with us here today in our hearing.

Let's go through the group in the order in which I introduced you to the record, and I'd like to ask you to be somewhere in the range of seven to eight minutes or so, if you can meet that. We just want to be sure that we keep the hearing moving in the way that all witnesses will be fairly heard. So just that for some guidance at the outset, and let's start with Mr. Peralta.

STATEMENTS OF MANUEL PERALTA, PRESIDENT, AMERICAN NATIONAL STANDARDS INSTITUTE, NEW YORK, NEW YORK; JOSEPH O'GRADY, PRESIDENT, AMERICAN SOCIETY FOR TESTING AND MATERIALS, PHILADELPHIA, PENNSYLVANIA; AND HELEN WOOD, PRESIDENT ELECT, IEEE COMPUTER SOCIETY, WASHINGTON, D.C.

Mr. PERALTA. Thank you, Mr. Chairman.

I'm President of the American National Standards Institute, commonly referred to as ANSI. I joined ANSI in January of this year, and I think it's pertinent to review some of my background, that I've held senior positions in both Government, with NASA, and in the private sector, with Exxon. My industry experience has involved a great number of assignments internationally, including spending time in Europe, in a number of countries, living there, so I know the international scene quite extensively.

Since becoming president of ANSI, I've devoted much of my time to events in the national standards arena, especially what is commonly referred to as EC-92. As a consequence of this, I've made a particular effort of meeting with key personnel involved in international, regional, and national standardization activities in the United States, in Europe, and, more recently, in Japan.

I welcome the opportunity to share with you ANSI's current activities and views on international standardization, and before doing so I'd like to provide you with a brief description of ANSI and note that 65 percent of ANSI's 1989 budget of $11 million is committed to the international activities, underscoring the importance of these activities.

ANSI is a private, not-for-profit, membership corporation founded in 1918 to coordinate the development of voluntary standards. ANSI does not develop standards and is very much a product of our free market enterprise system. Overall, ANSI's membership is very broad and includes over 1,000 companies and 250 trade and professional associations.

Currently, there are no major standards-developing organizations not holding membership in ANSI. ANSI's membership currently includes Federal, State, and local government agencies, professional and technical societies, trade associations, consumer groups, corporations, and educational institutions.

Finally, ANSI is the U.S. member body to nontreaty international standards organizations such as ISO and IEC. ANSI is a voting member on all important technical committees and holds key secretariats where U.S. interests have expressed a desire.

There are some 20,000 individuals participating in U.S. standards activities, 10 percent from the Government, 15 from associations, and the remaining 75 percent from private sector companies.

At this point in time, I would like to offer for the record ANSI's constitution, which I think you will find very interesting since it very much parallels what John Woods, my friend from Canada, described as his activities, and one of the main differences I would underscore is simply the aspects of funding. As I listened to John, many of the things that he described in what Canada did in the seventies the United States has done through ANSI and the overall coordination of the activities in the U.S., with the one exception of where the funding comes.

Mr. **Walgren.** We'd like to have that for the record, and we will include it at an appropriate place.

Mr. **Peralta.** I'd like to take a moment here to comment on the recent Congressional Research Service report which notes, "The complexity and diversity of standardization and standards issues is daunting," and, frankly, I think I have to agree with that statement, but I think it's important for me to provide some insights and clarifications to that report.

The first point I'd like to bring out is, ANSI is the coordinator of a diverse, distributed private sector voluntary standard system and enjoys widespread support among those actively involved in standards. Of the 600 standards developers noted in the CRS report, in fact, only 270 have active or ongoing programs, and 93 percent of these are members of ANSI.

Of the 23,570 standards developed by the 14 leading standards organizations identified in the report, 97.5 percent of these are developed by ANSI members following ANSI procedures and requirements.

Through ANSI, as the U.S. member body, the United States has realized a growing leadership position in international standardization of ISO and IEC. Currently, the U.S. holds over 12 percent of the major ISO technical bodies and, since 1970, has increased the U.S. leadership position by some 33 percent, and, in fact, only West Germany has enjoyed a similar increase, and the U.S. holds some 291 key leadership positions versus Japan, which holds 40.

In the IEC, the United States' predominant role is even more evident, and the secretariats involved with U.S. participation have increased by over 50 percent since 1970. Moreover, U.S. leadership is evident by examining the joint ISO and IEC committees on which the U.S. holds more than 25 percent.

The issue of numbers obviously is important, but perhaps more importantly is the quality of the secretariats that the United States holds. Through ANSI, the U.S. has secured secretariats in many of the more economically significant sectors—for example, aircraft and space vehicles, petroleum products, fiber-optics, banking, and information technology—and, in fact, as John reported earlier in his comments, the information technology secretariat managed by the United States is, in fact, the largest international activity under ISO and IEC.

The final comment is, where interest on behalf of American industry exists, ANSI has been highly successful in actively achieving a U.S. leadership position in ISO and IEC. Essentially, U.S. activities in international standardization has tracked private sector interest, and, significantly, standards developed in the international arena manifest themselves in many of the U.S.-based standards. Literally thousands of the ISO and IEC standards reflect U.S. technology.

The issue of EC-92 is obviously very pressing in everybody's mind, and I'd like to just sort of summarize very quickly ANSI's activities regarding EC-92. First is active participation in international organizations. As I mentioned earlier, (the U.S.)[1] represents ISO and IEC, and we're also using our leadership role to coordinate with CEN and CENELEC, and we've had an initial meeting with them to discuss issues of standards and transparency, and we'll be having a follow-up meeting with them this Friday.

Second, involvement and development of new CEN and CENELEC standards. ANSI solicits U.S. comments on draft standards through ANSI standards action and channels this input into the development of the European standards.

Third is greater presence in Europe. We have requested observer status to CEN and CENELEC and have established a European on-site office in Brussels to better assess the developments in Europe.

Fourth is harmonization of U.S. and European certification and testing, and ANSI is involved in understanding and establishing procedures by which the U.S. can achieve mutual recognition and equal access for non-Community products.

Dissemination of information is a very key role of ANSI in supplying national, regional, and international standards. We provide standards to all ISO members, many of which are developing countries and, in fact, will soon be releasing the most comprehensive book ever written on standards.

Finally, very significantly, coordination of the private sector and Government activities is something that I've been personally very much involved with in working with the Department of Commerce to form what I've called a national partnership in dealing with the issues of EC-92 and global competitiveness.

I think it's fair to say that it is essential in this day and age that Government and the private sector speak with one voice and our efforts are coordinated. In fact, this was an item very significantly highlighted in a recent MIT report which noted that very frequently Government and private sector are working at cross purposes with each other.

[2]The last comments I would like to do is really to summarize some of the points that are in my testimony, and there are really five points that I would like to reinforce. The first is that the U.S. voluntary standards system mirrors our culture and commitment to the free enterprise system. The market dictates the extent of participation by companies and industries in the international standards work which results in an optimum utilization and allocation of resources.

The second is, as the U.S. member body to the major international nontreaty standards bodies, ANSI will continue to be responsive to the needs of American industry. Additional funding would certainly assist in this mission. However, we believe that such funding can best be provided by the private sector, as it has in the past.

Third, where U.S. industry seeks a leadership role in the technical committees of ISO and IEC, ANSI has aggressively sought to achieve such a position with a great deal of success and will continue to do so.

Fourth, Government has an important role to play in the voluntary standards system. Its traditional role should be reinforced without altering the basic character and nature of the system that has achieved a system that is first among equals and unparalleled in its resiliency and adaptability. In fact, in 1984 ANSI received a Government commendation for its efforts in coordination of the U.S. voluntary standards efforts.

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[1] See Appendix.

[2] See Appendix.

The system is good, there are certainly things that can be done to improve it, and we're making significant progress toward strengthening the system where it needs to be to adapt to today's environment.

Finally, ANSI stands willing to work in a productive partnership with the Department of Commerce and other bodies of Government to enhance the global competitive position of the United States through standards technology.

Thank you.

[The prepared statement of Mr. Peralta follows:]

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STATEMENT OF THE AMERICAN NATIONAL STANDARDS INSTITUTE

CONCERNING

INTERNATIONAL VOLUNTARY STANDARDIZATION

PRESENTED BY

MANUEL PERALTA,
PRESIDENT OF THE AMERICAN NATIONAL STANDARDS INSTITUTE

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
OF THE
HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

JULY 25, 1989

I. INTRODUCTION

Mr. Chairman, Members of the Subcommittee, my name is Manuel Peralta, and I am the President of the American National Standards Institute ("ANSI"). I have served in that capacity since January 1, 1989. Prior to that time, I was a member of ANSI's Board of Directors, served on ANSI's International Advisory Committee, and held various positions in the government (NASA) and in private industry (Exxon). Much of my prior experience has involved international activity, including extended assignments in a number of foreign countries.

I am pleased to be here today, at the invitation of the Subcommittee, to discuss ANSI's role as the U.S. member body to the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). In 1989, more than sixty percent (60%) of ANSI's $10 million budget will be devoted to international standards work. That allocation of resources reflects ANSI's recognition of the growing importance of international activity to the voluntary standards community and this country's global competitive position.

Since becoming President of ANSI six months ago, I have devoted much of my time and attention to the rapidly evolving events in the international standards arena, most especially the European initiative commonly referred to as EC-1992. After meeting with Secretary Mosbacher in March, I travelled to Europe for the purpose of meeting with the Secretary Generals of both

ISO and IEC, as well as key officials in both CEN and CENELEC. I also met during that trip with the heads of some of the major national standards bodies in Europe -- such as BSI, DIN and AFNOR. Thereafter, I travelled to Japan to meet with key standards officials in that country.

These meetings provided me with further insight into the present day situation in the international arena. More importantly, perhaps, they enabled me to formulate a good sense of what lies ahead. Armed with this knowledge, and working with an experienced staff, I have sought to institute new programs at ANSI, and to modify others, with the goal of fully satisfying the interests and objectives of ANSI's constituency -- the voluntary standards community in the United States. I welcome the opportunity to share some of my ideas and plans with you.

Before doing so, however, I would like to provide a brief description of ANSI and the work it performs -- both domestically and abroad. It has been my experience that too often the efforts made by ANSI have not been adequately understood and sufficiently appreciated.

II. DESCRIPTION OF ANSI

ANSI is a private, not-for-profit membership corporation that was founded in 1918 in order to coordinate the development of voluntary standards. A number of government agencies were instrumental in, and supportive of, the effort to create ANSI. Over the years, an effective working partnership in the standards area has been realized by government and the private sector. In 1984, President Reagan awarded ANSI a Private Sector Initiative Commendation for its administration and coordination of the voluntary standards effort in the United States.

As set forth in its Constitution, the purposes of ANSI include:

- Serving as the national coordinating institution for voluntary standards activities in the United States through which organizations concerned with standards may cooperate in establishing, improving and approving standards -- based on a consensus of all parties-at-interest;
- Furthering the voluntary standards movement as a means of advancing the national economy; benefiting the public health, safety and welfare; and facilitating domestic and international trade and commerce;
- Establishing, promulgating and administering procedures and criteria for the recognition and approval of standards as American National Standards so as to encourage existing organizations to prepare and submit such standards for approval; and
- Representing the interests of the United States in international non-treaty standardization and certification organizations.

Although ANSI does not itself develop standards, over the past 70 years ANSI has facilitated the development of tens of thousands of consensus standards by a variety of technical groups, trade associations, professional bodies, labor organizations, consumer groups, governmental agencies and commercial industries. ANSI's members currently include federal, state and local government agencies, professional and technical societies, trade associations, corporations and educational institutions.

ANSI ensures that voluntary standards submitted to it for approval as American National Standards are developed through due process and that such standards reflect a true consensus of all materially interested parties. ANSI encourages the development of new standards where needed, provides the required organizational structure, and offers a forum for voluntary resolution of disputes in the standards area. ANSI is also the arena in which private industry and governmental agencies interact on an ongoing basis in an effort to establish the best possible standards, certification programs, and procedures.

ANSI has long served, and continues to serve, as the member body to, and representative of United States interests in, the ISO and the IEC[1] -- the two leading non-treaty standards organizations at the international level. On behalf of the United States, ANSI is a voting member of virtually all important ISO and IEC technical committees and subcommittees. ANSI holds secretariats in these committees, directly or by delegation to others, in sectors where U.S. interests are most affected by the promulgation of standards and U.S. industry has expressed a desire to hold a leadership position. On other committees where U.S. interests are not as great, ANSI holds observer status.

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[1] The designated U.S. representative to IEC is the U.S. National Committee (USNC/IEC), which is a part of ANSI.

Delegates to ISO and IEC technical committees and subcommittees are drawn from Technical Advisory Groups (TAGs) established and accredited by ANSI. TAGs develop positions on ISO and IEC standards with a view towards ensuring the greatest possible alignment of international standards with national standards and furthering the interests of all materially affected U.S. parties. TAGs also verify that delegates to ISO and IEC committees and subcommittees possess the required technical expertise. There are approximately 20,000 individuals who participate in 140 TAGs. Participants in the system (10% government, 15% technical and trade organizations, 75% businesses) help to develop U.S. positions on standards developed by over 2,200 international committees and subcommittees. In addition to coordinating and monitoring the U.S. effort, ANSI takes an active role in training individuals to represent the United States in international standards development work.

With respect to international standards organizations other than ISO and IEC, ANSI maintains frequent communication and liaison with the European Committee for Standardization ("CEN") and the European Committee for Electrotechnical Standardization ("CENELEC"). ANSI is also a member and the U.S. representative to the Pacific Area Standards Congress and an observer to the European Telecommunication Standards Institute. In 1979, when the GATT countries developed a standards code, ANSI was instrumental in representing U.S. interests. ANSI maintains copies of, and distributes, standards promulgated by the ISO, IEC, CEN, CENELEC, and individual countries who are major trading partners with the United States. ANSI also provides copies of American National Standards to all members of ISO -- many of whom would be classified as developing nations.

Through a bi-weekly publication called Standards Action, ANSI informs American industry of new and proposed standards in the domestic and international arena so that U.S. producers and suppliers can stay up to date and participate in a timely fashion. As the importance of standards has come to be better appreciated by American industry and government, ANSI has seen renewed interest in its work and enthusiasm for the vital role it plays in representing U.S. public and private interests abroad.

III. CLARIFICATION OF ANSI'S ROLE AND EFFORTS IN INTERNATIONAL STANDARDS

ANSI has received a copy of a report entitled "International Standardization: The Federal Role," which was prepared by Lennard G. Kruger on behalf of the Science Policy Research Division of the Congressional Research Service (the "CRS Report"). As the CRS Report notes, "the complexity and diversity of standardization and standards issues is daunting." CRS Report at 44. That likely explains why the CRS Report contains certain errors in its description of international standards work, and particularly ANSI's role in the system, that I wish to correct at this time.

A. The CRS Report states that "In the U.S. voluntary standards are managed by a diverse, scattered and largely uncoordinated network of private sector entities." CRS Report at 45. Further, it states that "Unlike most countries, the U.S. does not rely on one national standards organization to act as an official umbrella for all standardization activities." CRS Report at 10.

It certainly is true that many different organizations are involved in standards work in this country -- a feature that is one of the great strengths of our system. However, that does not suggest a lack of overall coordination or the absence of an "umbrella" organization guiding the effort. To the contrary, ANSI has for many years performed this role -- and performed it well -- both domestically and internationally.

The "primary concern" of the CRS Report is "engineering standards" (p. 3).[2] With respect to these types of standards, the vast majority developed in the United States are either approved as American National Standards or otherwise developed by members of ANSI who subscribe to its principles and leadership role. Indeed, of the fourteen (14) leading developers of industrial standards in the United States identified in Table IV of the CRS Report (p. 12), twelve (12) are members of ANSI. Further, of the 23,570 standards developed by the fourteen organizations listed in the CRS Report, 22,980 (or 97.5%) are developed by members of ANSI.

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[2] The CRS Report states that in total there are approximately 89,000 "standards" in the United States. CRS Report at 8. But, 50,000 of these "standards" are actually procurement specifications developed and used by government (CRS Report at 12), not standards.

As for the remaining 39,000 "private standards," the CRS Report states that only 20% have been adopted as American National Standards (p. 11). I would like to note that many of these "private standards" are not eligible for designation as American National Standards because they were not produced by a consensus process. Absent consensus, such standards are also not eligible for adoption under OMB Circular A-119.

At the present time, ANSI has close to 250 organizational members who are active in developing standards. While there may be 600 private organizations that are occasionally involved in standards activities (CRS Report at 10), according to R.B. Toth Associates (a source relied upon in the CRS Report) only "about 270 standards developers have ongoing standardization programs." Thus, of the active standards developers, approximately ninety-three percent (93%) are members of ANSI. Indeed, ANSI is able effectively to discharge its coordinating role for the voluntary standards system in the United States precisely because of the widespread support it receives from those actively involved in standards work.

B. The CRS Report also suggests that the U.S. "lags behind Western European countries in ISO and IEC secretariats held" (p. 17) and that the U.S. has a "lower level of participation in ISO and IEC (compared to Western European countries) (p. 16)." These statements create the unfortunate, and mistaken, impression that the United States has failed to assume a proper leadership role in international standards efforts.

At the present time, close to ninety (90) countries are represented in ISO and more than seventy (70) are members. The United States holds the secretariat in 17 ISO Technical Committees and 64 ISO subcommittees. It heads up 210 ISO Working Groups. That translates into a primary leadership role in 12.2% of the major sub-bodies of ISO. Since the 1970s, the percentage of total leadership positions held by the United States in ISO has increased by 33%. While certain countries in Western Europe continue to enjoy a slightly greater percentage of leadership positions in ISO, the differential has been narrowed considerably over time. Indeed, during the last two decades, the percentage of leadership roles in ISO held by the United Kingdom and France has fallen and remained flat, respectively. Only West Germany has enjoyed an increase in leadership positions similar to that of the United States. The United States continues to hold many more leadership roles in ISO than Japan (291 to 40).

In the IEC, the prominent role assumed by the United States in recent years is even more evident. Of the forty-two (42) countries represented in IEC, only France holds the secretariat of more technical committees and subcommittees. In recent years, the United States has increased its leadership role in IEC by more than 50% -- far more than the United Kingdom, France or West Germany. At the present time, the United States holds 32 secretariats in IEC Technical Committees and subcommittees. By comparison, Japan holds but 3.

The active and aggressive role played by the United States is particularly well shown by its leadership of joint ISO/IEC committees. In these committees, which tend to involve subjects of great economic importance, the leadership role of the United States is unmatched by any country, as the CRS Report acknowledges (p. 15). More than one-quarter of all such secretariats are held by the United States.

Moreover, the "quality of secretariats held can be as important as the quantity." CRS Report at 15. The record demonstrates that through ANSI the United States has managed to secure secretariats in many of the most economically significant sectors, including aircraft and space vehicles, petroleum products, fiber optics, plastics, and banking and related financial services. ANSI also administers the secretariat in JTC-1 on Information Technology, which is the largest international technical committee and is responsible for over 800 standards projects. JTC-1 has established a new benchmark for the efficient and expeditious processing of standards.

ANSI fully agrees with the conclusion of the CRS Report that "ultimately, it is U.S. companies themselves . . . that determine the level of U.S. participation in ISO and IEC" (p. 15). Where the interest and commitment on behalf of American industry are present, ANSI makes an aggressive and effective effort to ensure that the U.S. achieves a leadership position in

ISO and IEC, and it will continue to do so -- at very little cost to the American taxpayer.

IV. PUBLIC VERSUS PRIVATE COORDINATION OF INTERNATIONAL STANDARDS ACTIVITIES

Many commentators have noted that the United States is unique because its interests are not represented at the ISO and IEC level by a government body or an entity that receives substantial governmental funding. It is certainly true that the U.S. system of international standards representation is different from the systems used by many other nations. It is also true that the advantages of ANSI's coordination of international standards efforts are many, particularly when compared to an alternative system controlled by government.

In the U.S., participation in international standards activities is a reflection of market interests in standards development. To the extent that international standards have an important and meaningful impact on a particular industry or interest group, participation in international standards development will receive active support, financially and otherwise. That has always been the case. The "bottom line" is that the present system ensures that materially interested parties will seek access to the international standards development process and bear the expense associated with that activity. That is what our free enterprise system envisions.

Perhaps for this reason, the voluntary system in the United States has been, and continues to be, extremely efficient and effective. I know of no other nation that produces as many quality standards in as short a period of time and at such a relatively small cost. Moreover, under ANSI procedures all American National Standards must be reviewed (and affirmed, modified or withdrawn) every five years -- a requirement that ensures that voluntary standards in this country keep pace with developing technology and innovations. Thus, the voluntary system produces quality standards that do not become outdated.

Private industry has long believed that undue government control and involvement would pose a threat to the system that has worked so well for so many years. Government control involves more time, more cost, and often produces an inferior product. As the Chairman of the Consumer Product Safety Commission succinctly observed: "Voluntary standards are more quickly implemented, cheaper for the taxpayer, and less litigious than government promulgated safety standards." Pursuant to OMB Circular A-119, agencies of the executive branch defer to the development of consensus standards by the private sector. The Department of Defense and other government agencies -- federal, state, and local -- have formally adopted thousands of voluntary standards. Some of those standards -- like the National Electric Code and the Boiler Code (both of which are American National Standards) -- are thousands of pages long. Government adoption is a good indicator of the contribution made by the voluntary system, and the present trend should be accelerated.

Government funding of voluntary standards efforts represents less intrusion into the system. However, even this type of activity is not without some problems. First, under the present system the marketplace dictates participation in standards work. If the market indicates a need for involvement, organizations and industries participate and provide funding. Government funding could lead to artificial dislocations in resource commitment, which obviously is undesirable. Second, by what criteria would funding be provided? How does one measure whether a particular industry or a particular standards developer is in need of funding assistance? Why is that industry or organization more deserving than another? In the present system, these difficult judgments are made by the marketplace.

With respect to government financing of standards assistance to developing countries, many of the same issues are presented. Under the current system, if market realities dictate that assistance is warranted, it is provided by individual companies and/or organizations -- at no cost to our government, which already is laboring under substantial deficits. If funding of standards assistance were provided by the government to developing countries, what criteria should be applied? Must the country be a signatory to the GATT Standards Code? A member of ISO? Moreover, such funding clearly implicates larger issues of foreign and trade policy with particular countries. To what extent should these matters be factored into government funding decisions?

My comments should not be understood to suggest that there is no role for government to play in standards work. To the contrary, there is a very important role to be fulfilled. Many government employees participate in the voluntary standards system when the interests of the government justify such involvement. That participation is vitally important and should be continued -- along with whatever funding is required to assure such participation.

Similarly, it is the government that is and should be responsible for trade policy and assuring that artificial barriers to free trade are not created. If a particular nation attempts to use standards and certification activities as a means of excluding U.S. industry, the government should address the matter forcefully -- government to government.

Moreover, the existing partnership between government and the private sector in the standards area should be nurtured and expanded. ANSI has recently proposed to the Department of Commerce the creation of a formal National Partnership with a view towards furthering U.S. global competitiveness through the standards process. In short, the traditional role of government in voluntary standards should be reaffirmed. What should not be done is to change the basic nature and scope of the highly effective and productive voluntary standards system in this country.

V. THE IMPACT OF EC-1992 STANDARDS AND CERTIFICATION DEVELOPMENTS ON U.S. INTERESTS

Standards and certification play a vital role in the EEC's ambitious plan to create a single, barrier free internal market in goods, services, persons and capital by 1992. Because liberalized European trade is one of the predominant objectives of EC-1992, the EEC has adhered to the principle set forth in the celebrated Casis de Dijon case: that national standards cannot be used as a means to restrict the sale of goods in one EEC member state that are legitimately sold in another EEC member state. Indeed, the first EEC Directive[3] concerning European standards mandated that no member state create new technical standards that would serve as a barrier to Community-wide trade.

As the EEC debated over measures in the standards area in order to achieve the objectives of EC-1992, the Commission determined that it would be necessary to develop Community-wide standards in some areas (e.g. technology and telecommunications, pharmaceuticals, medical products, construction equipment and food products). However, in the majority of sectors, the EEC decided that it would not endeavor to set Community-wide standards and would, instead, operate under the principle of mutual recognition of member state standards. Consequently, the

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[3] EEC Council Directives are drafted by the Commission. When draft Directives are completed by the Commission, they are submitted to the Council, which then votes on proposed Directives. After a Directive has been adopted by the Council, EEC member states are required to enact implementing legislation on the national level by the deadline set forth in the Directive.

EEC continues to rely heavily on existing standards set forth by CEN and CENELEC which, in turn, coordinate standards set by ISO and IEC that have been adopted (in whole or in part) by the various EEC member state organizations.

In certification and testing, the EEC has proposed a Directive in order to harmonize procedures for certification and testing throughout the EEC. Such procedures would be used by all testing authorities throughout the Community in order to certify compliance with CEN, CENELEC or national standards.

Given the vital significance of standards and certification and the paramount importance of the European market,[4] we know that EEC standards and certification efforts will, by definition, have major consequences for U.S. producers and suppliers. The real question is will these developments be good or bad for U.S. interests? There is an understandable sense of uneasiness and uncertainty within the United States about the implications of 1992. Some of these concerns focus on the fear that the Community, by harmonizing the standards of its various member states, will establish criteria that can only be achieved by producers and suppliers within the Community.

Indeed, harmonizing causes some U.S. producers and suppliers to fear that 1992 will ultimately lead to a "fortress

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[4] The EEC, taken as a whole, will constitute a market of 320 million people, with a Gross Domestic Product of US $2.7 trillion, exports of US $680 billion and imports of US $708 billion. Furthermore, this market is a major consumer of U.S. products. In 1988, roughly US $4.5 billion or 24% of all U.S. exports were sold to the Community.

Europe" impenetrable to U.S. entities. Reinforcing this perception is the concern by U.S. trade negotiators that the Community is advancing rapidly toward meeting its goal of completing the internal market by 1992, while at the same time EEC enthusiasm for the latest GATT negotiations as part of the Uruguay Round appears to be less significant.

Despite these concerns, there may be reason to view EC-1992 as a very positive opportunity for U.S. producers and suppliers in Europe. First, it is important to recognize that EEC producers and suppliers will not be the only entities to benefit from Community-wide standardization. Certainly U.S. companies will find it easier to provide goods and services to a Europe governed by uniform standards. Second, in most cases the EEC will defer to CEN and CENELEC to coordinate standards throughout the Community. In turn, CEN and CENELEC are obligated to defer to ISO and IEC standards, except in sectors where these international bodies have failed to promulgate standards. Thus, to the extent that ISO and IEC have developed standards, ANSI's role as the U.S. representative to these organizations is the key to U.S. input to community standards.

VI. ONGOING AND FUTURE ACTIVITIES OF ANSI

In view of its pivotal role, ANSI has already undertaken some important initiatives with respect to the EEC and international standards generally. Further, ANSI is in the process of developing new programs on an ongoing basis.

A. The European Economic Community.

Given the important implications of EC-1992 in the area of standards and certification, ANSI has undertaken significant initiatives to further the interests of U.S. producers and suppliers in Europe.

1. Active Participation in International Organizations:

As the U.S. representative to the ISO and IEC, ANSI has worked, and will continue to work, vigorously to facilitate the adoption and recognition of international standards -- standards that the EEC will be obliged to recognize and that in many instances substantially mirror American National Standards. There can be little doubt that standards developed in the United States form the basis of literally thousands of ISO and IEC standards. By working to develop international standards, ANSI can also use its leadership role to coordinate with CEN and CENELEC to assure that ISO and IEC standards are honored and that transparency occurs.

2. Involvement in the Development of New Standards:

Through ANSI's existing relationship with CEN and CENELEC, it is in a position to review draft standards proposed by such bodies. ANSI has been, and will continue to be, a clearinghouse that serves as a vital source of information concerning draft CEN and CENELEC standards. By soliciting comments from U.S. interests and helping to coordinate their input, ANSI will be able to channel and make known U.S. positions on the development of European standards so that harmonization will be beneficial for European and U.S. parties alike.

3. Greater ANSI Presence in Europe through a New Brussels Office:

Because it fully appreciates the importance of emerging harmonization of standards in the Community, ANSI is working to increase its presence in Europe. ANSI has requested formal observer status to CEN and CENELEC, and it currently is in the process of establishing an office in Brussels, which will be open by August of 1989. Through the Brussels office, ANSI will be at the pulse of the latest EEC developments in the standards and certification area.

4. Harmonization of U.S. and European Certification and Testing:

ANSI's current structure enables it to accredit third party programs for certification and testing. Thus, a mechanism already exists by which ANSI could potentially accredit certification and testing procedures as being in compliance with European criteria. ANSI intends to work to establish procedures and understandings with European authorities whereby ANSI accreditation status will be treated reciprocally in Europe. A meeting between ANSI and CEN/CENELEC to discuss certification and other important subjects will take place on July 28 -- just three days from today.

5. ANSI Dissemination of Information:

Through Standards Action, ANSI will continue to keep U.S. interests up to date on all new standards being developed in

Europe. In addition to circulating draft standards for comment by U.S. parties, ANSI will continue to distribute ISO and IEC standards to interested American suppliers and manufacturers.

B. Education As to the Importance of Standards.

Part of the difficulty of ANSI's task arises from the fact that the general public and certain industries are relatively unaware of the paramount importance of standards and the benefits to be derived from participation in the process. Therefore, one of ANSI's objectives is to campaign hard through its various members in order to educate the general public as to the importance of standards and the role that such standards play in the world of international trade. Certainly assistance from government in this effort would be welcomed and should be encouraged.

For its part, ANSI will soon be releasing the most comprehensive book ever written concerning the proper use of standards by American business. Entitled Standards Management: A Handbook for Profits, the book, which is more than five hundred pages long and was written under the director of ANSI's Company Member Council, will represent vital source material both for companies already knowledgeable about standards work and those that are not. The book is now at the printer and ANSI would be pleased to provide a copy to the Subcommittee.

C. Coordination of Government and ANSI Activity.

Beyond my earlier comments, what can the U.S. government do to support ANSI's efforts in this area? Given the commercial interests at stake for U.S. manufacturers and suppliers in the international standards area, it is important that private industry and the government speak with a unified message. To do otherwise would be totally counter-productive at this crucial time. As highlighted in a recent study prepared by M.I.T., government and private industry cannot afford to work at cross-purposes.

Instead, the U.S. government and ANSI need to work together to: 1) better coordinate and integrate U.S. government and private sector activities regarding the EEC's rapid transition to a unified market in 1992 and 2) raise the general awareness of U.S. producers and suppliers as to the strategic significance of standards technology and U.S. competitiveness in today's global economy. The formal partnership proposed by ANSI to the Department of Commerce will facilitate government efforts and will help to prevent divergence of action or duplication of effort. For example, government endorsement of ANSI testing and certification programs could be a critical element in allowing ANSI to coordinate internationally with testing and certification authorities. Certainly ANSI will rely heavily on the federal government's continued exercise of its political and diplomatic role in enhancing world trade. ANSI has worked well with the Department of Commerce and the United States Trade Representative in the past, and it remains committed to do so in the future. Since my meeting with Secretary Mosbacher in March, I have been working and coordinating with Mr. Michael Farren, Undersecretary r International Trade of the Department of Commerce. That fort will continue.

The global interests of U.S. manufacturers and ppliers are in a period of transition. The changes that will sult from EC-1992 and global economic shifts may provide U.S. rties with unprecedented opportunities. To a large degree, the te of U.S. entities worldwide will depend on the ability of terested parties in the United States to work together toward mmon goals. That objective should be fully attainable through coordinated partnership between the government and private dustry with ANSI leading the way in representing the interests f the U.S. in standards and certification matters, as it has in he past.

In summary, I would like to emphasize the following oints for the Subcommittee:

1. The voluntary standards system in the United States is unmatched in the world -- it is efficient, cost-effective, highly productive and results in the promulgation of thousands of quality standards each year.

2. As the coordinator of the voluntary standards system domestically and the U.S. member body to the major international non-treaty standards bodies, ANSI has been and will continue to be responsive to the needs of American industry. Although additional funding would certainly assist ANSI's mission, ANSI believes that any such funding can be provided by the private sector -- as it has in the past.

3. Where U.S. industry seeks a leadership role in the technical committees of ISO and IEC, ANSI has aggressively sought to achieve such a position with a great deal of success, and it will continue to do so.

4. The voluntary standards system mirrors our culture and commitment to free enterprise. The market dictates the extent of participation by companies and industries in international standards work, which results in the optimum utilization and allocation of resources.

5. While government has an important role to play in the voluntary standards system, it would be a serious mistake to alter the basic character and nature of the system.

6. ANSI stands willing to work in a productive partnership with the Department of Commerce and other bodies of government to enhance the global competitive position of the United States through standards technology.

Thank you for your time and attention.

Constitution
and Bylaws
# of the American
National
Standards
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Constitution

C1. Name

The name of this corporation shall be the American National Standards Institute, Incorporated, hereinafter referred to as the Institute.

C2. Purposes

The purposes of the Institute shall be:

(1) To serve as the national coordinating institution for voluntary standardization and related activities in the United States of America through which organizations concerned with such activities may cooperate in establishing, improving, and approving standards, based on a consensus of parties-at-interest, and certification programs to the end that such activities remain dynamically responsive to national needs; that duplication of work is avoided; and that individual enterprise and initiative are encouraged.

(2) To further the voluntary standards movement as a means of (a) advancing the national economy; (b) benefiting the public health, safety, and welfare; (c) facilitating domestic and international trade, commerce, communications, and understanding.

(3) To assure that the interests of the public, including consumers, labor, industry, and government, may have appropriate protection and participation and representation in standardization, certification, and related activities.

(4) To provide the means for determining the need for new standards and certification programs; to assure activity by existing organizations competent to resolve the need; and to work toward establishment of suitable groups for these purposes where such do not already exist.

(5) To establish, promulgate, and administer procedures and criteria for the recognition and approval of standards as American National Standards so as to encourage existing organizations and committees to prepare and submit standards for such approval by the Institute.

(6) To establish, promulgate, and administer procedures and criteria for recognition and accreditation of certification programs and to encourage existing organizations to prepare and submit certification programs for such accreditation by the Institute.

(7) To cooperate with departments and agencies of federal, state, and local governments in achieving optimum use of American National Standards in regulation and procurement.

(8) To promote knowledge and use of American National Standards and accredited certification programs.

(9) To represent the interests of the United States of America in international nontreaty standardization and certification organizations with which it is or may become affiliated.

(10) To serve as a clearinghouse for information on standards and standardization, certification, and related activities in the United States of America and abroad.

C3. Basic Principles

The approval of a standard by the Institute implies a consensus of those substantially concerned with its scope and provisions. In standardization practice a consensus is achieved when substantial agreement is reached by concerned interests according to the judgment of a duly appointed authority as defined in the Bylaws. Consensus implies much more than the concept of a simple majority, but not necessarily unanimity.

C4. Membership

C4.1 Types. There shall be six classes of members: organizational members; governmental members; company members; sustaining members; individual members; and honorary members. The privileges, responsibilities, and eligibility requirements of members shall be as defined in the Bylaws.

C4.2 Dues and Voting Rights. Members shall pay the annual dues and charges for special services and shall have the voting rights provided for in the Bylaws.

C5. Board of Directors

C5.1 Function. The Board of Directors shall be the governing body of the Institute. The Board may delegate any part of its authority over conduct of the affairs of the Institute to the full extent permitted by law.

C5.2 Composition. The Board of Directors shall be composed of not less than fifteen and not more than sixty members. It shall include the chairman, the immediate past chairman, and the vice-chairmen.

Additional directors shall be elected and vacancies in the Board shall be filled in accordance with the procedures set forth in the Bylaws.

C5.3 Election. Election of directors shall take place at such intervals and for such terms as are provided in the Bylaws.

C5.4 Board Committees. The Board of Directors shall elect an Executive Committee of its members to whom it may delegate authority to act on behalf of the Board in the interim between Board meetings. The Board shall establish the committees specified in the Bylaws and may, by resolution, establish other committees having such membership, duties, and responsibilities as the Board may consider advisable.

C6. Officers

The Institute shall have a chairman, one or more vice-chairmen as specified in the Bylaws, a president, a secretary, and such other corporate officers as the Bylaws prescribe. Corporate officers may hold more than one office when permitted by the Bylaws.

The chairman and vice-chairmen shall be elected by the Board of Directors in the manner prescribed in the Bylaws.

C7. Councils, Boards, and Committees

The Institute shall have such councils, boards, and committees as may be deemed necessary to carry out its purposes. They shall have the rights and duties set forth in the Bylaws.

Each council, board, and committee shall operate under procedures developed by it and approved by the Board of Directors.

C8. Bylaws

Bylaws shall be adopted which are consistent with this Constitution.

C9. Amendments

C9.1 Origin. Amendments to this Constitution may be proposed by any ten voting members of the Institute, or any three members of the Board of Directors, and shall be submitted to the president in writing. The secretary shall mail a copy of the proposed amendment to each member of the Board of Directors within thirty days of its submission and at least thirty days prior to the meeting of the Board at which the proposed amendment is to be considered.

C9.2 Board Action. The Board of Directors shall consider and act upon the proposed amendment at the designated Board meeting. Approval for submission to the voting members of the Institute shall be by vote of three-fourths of those present and voting at such meeting.

C9.3 Action by Voting Members. Within thirty days of approval for submission to voting members by the Board, the secretary shall submit the text of the proposed amendment, with a statement of purposes, to letter ballot of the voting members of the Institute. Letter ballot returns shall be closed sixty days from the date of submission, and the amendment shall thereupon be effective if approved by two-thirds of the members voting.

C9.4 Petition. If the Board of Directors fails to act on or to approve a proposed amendment for submission by the secretary to the voting members – pursuant to the procedures and with the effect set forth in C9.2 and C9.3 – upon the written petition of any twenty-five voting members of the Institute, the president shall submit the text of the proposed amendment, with a statement of purposes, in letter ballot of the voting members of the Institute. Letter ballot returns shall be closed sixty days from the date of submission, and the amendment shall thereupon be effective if approved by two-thirds of the members voting.

C10. Use of Assets on Dissolution or Liquidation

Upon dissolution or final liquidation of the corporation, after discharge or satisfaction of all outstanding obligations and liabilities, the remaining assets, if any, shall be distributed in accordance with the determination of the Board of Directors of the Institute, and in compliance with the Constitution and Bylaws of the Institute and all federal and state laws applicable thereto, to an organization or organizations organized and operated under federal or state law for similar educational, scientific, or charitable purposes.

Bylaws

B1. Membership

B1.1 Applicants. Applicants for membership in the Institute shall subscribe to its purposes and principles, as set forth in its certificate of incorporation and its Constitution and Bylaws. By accepting membership in the Institute, each applicant agrees to observe all the provisions of the certificate of incorporation and the Constitution and Bylaws; and to pay promptly all dues and charges for special services levied in accordance with the Bylaws and resolutions adopted from time to time by the Board of Directors.

B1.2 Acceptance. Upon written application to the president, an applicant may be admitted to a specified class of membership in the Institute by a vote of three-quarters of the Board of Directors present and voting at any meeting or voting on letter ballot. In case of dispute, the Board by such vote shall determine the applicant's appropriate class of membership.

B1.3 Types of Membership

B1.3.1 Organizational Member. An organizational member shall be a nonprofit scientific, technical, professional, labor, consumer, trade, or other association or organization that is of such scope and recognition and that is so organized that in the opinion of the Board of Directors it can properly participate in the development of standards and related activities.

B1.3.2 Governmental Member. A governmental member shall be a department or agency of the United States government or of any of the states or an interstate or regional authority or agency, or any subdivision of such entities interested in the work of the Institute.

B1.3.3 Company Member. A company member shall be a corporation, company, firm, partnership, or other organization that is engaged in industrial or commercial enterprise or professional, educational, research, testing, or trade activities. Any affiliate, division, or joint venture of a corporation, company, firm, or partnership may, at the discretion of the Board of Directors, be eligible for membership.

B1.3.4 Sustaining Member. A sustaining member shall be an organization, not otherwise eligible for membership, interested in development of standards or in related activities. A sustaining member, upon expression of substantial interest, may attend meetings of any of the councils or boards with the permission of its chairman.

B1.3.5 Individual Member. An individual member shall be a person interested in development of standards or in related activities. An individual member, upon expression of particular interest, may attend meetings of any of the councils or boards with the permission of its chairman.

B1.3.6 Honorary Member. An honorary member shall be an individual chosen by the Board of Directors for eminent service in carrying out the purposes of the Institute. A unanimous vote of the members of the Board of Directors present shall be required for the election of an honorary member, who shall pay no dues. Election to honorary membership shall be for life.

B1.4 Voting Rights. Each organizational member, governmental member, and company member shall have one vote on matters presented to the Institute. Sustaining, individual, and honorary members shall have no vote.

B1.5 Termination of Membership. Voluntary termination of membership shall be by notice in writing to the president. The Board of Directors may, by majority vote of the entire Board, terminate the membership of any member for failure to meet membership obligations other than nonpayment of dues. Membership shall be terminated for failure to pay dues within one year of date of invoice, provided that a first and second notice of delinquency shall have been given.

B2. Finances

B2.1 Dues. Membership dues shall be established by resolution approved by three-fourths of the entire Board of Directors.

B2.2 Institute Services. The Board of Directors shall:

(1) Determine regular services, including publications, to which a member shall be entitled

(2) Define those services, facilities, and materials that shall be subject to charges by the Institute, and determine the amount to be paid for such services

(3) Publicize its decisions with respect to (1) and (2)

B2.3 Gifts and Grants. Acceptance by the Institute of gifts, grants, or funds, other than those received for dues and services defined in B2.2, shall be subject to the approval of a majority of the entire Board of Directors.

B2.4 Administration. The Board of Directors shall:

(1) Establish an annual budget based on recommendations of the president and with guidance from the Finance Committee of the Board

(2) Authorize acceptable accounting and disbursement procedures for all funds under jurisdiction of the Institute

(3) Require an annual audit by a certified public accountant

(4) Arrange at Institute expense for the bonding of appropriate personnel of the Institute

B3. Board of Directors

B3.1 Composition. The Board of Directors shall be comprised as follows and its members shall be elected or shall hold their respective offices as hereinafter provided in these Bylaws:

(1) The chairman

(2) The immediate past chairman

(3) Three vice-chairmen

(4) The director of the National Bureau of Standards or his designated alternate

(5) The chairman of the Executive Standards Council

(6) The chairman of the Board of Standards Review

(7) The chairman of the International Standards Council

(8) The chairman of the Organizational Member Council

(9) The chairman of the Company Member Council

(10) The chairman of the Consumer Interest Council

(11) The chairman of the Certification Committee

(12) Twelve directors nominated by organizational members

(13) Twelve directors nominated by company members

(14) Three directors nominated by the Consumer Interest Council

(15) Up to nine directors from among federal governmental members and other representatives of government organizations qualified for membership after consultation with appropriate government officials

(16) Three directors-at-large nominated by the Board Nominating Committee

B3.2 Term. Each of the directors designated in B3.1(12) through B3.1(16), nominated and elected pursuant to B5, shall serve for a term of three years or until his or her successor is elected. Elected directors may serve for a maximum of two consecutive terms in any one office. At the annual meeting following the initial adoption of these Bylaws, the term of each director shall be stated by the Board Nominating Committee to be one, two, or three years, so that one-third of the offices of such directors shall thereafter be vacated each year. The terms of officers and elected members of the Board of Directors shall commence at the beginning of the fiscal year.

B3.3 Quorum. The presence of two-fifths of the members of the Board of Directors shall constitute a quorum at any meeting of the Board. Unless otherwise specified in the Constitution and Bylaws, the Board shall act by majority vote of those present, at any meeting at which a quorum is present. A director serving in more than one capacity on the Board shall have only one vote.

B4. Officers

B4.1 Chairman and Vice-Chairmen

B4.1.1 The Institute shall have a chairman of the Board of Directors. In the event of his absence or incapacity to act, one of the vice-chairmen shall be chosen by the Board of Directors to act as chairman.

B4.1.2 The Institute shall have three vice-chairmen with responsibilities assigned by the chairman. One vice-chairman shall serve as chairman of the Finance Committee.

B4.1.3 The chairman shall serve for a term of one year and each vice-chairman shall serve for a term of three years or until his successor is elected; except that at the annual meeting following the initial adoption of these Bylaws, the term of each vice-chairman shall be stated by the Nominating Committee of the Board of Directors to be one, two, or three years, so that one of the offices of vice-chairman shall thereafter be vacated each year. The chairman may serve for a maximum of three consecutive terms, and the three vice-chairmen for a maximum of two consecutive terms.

B4.2 Chief Staff Executive and Secretary

B4.2.1 The Board of Directors shall designate a chief staff executive, whose title shall be president and who shall serve as chief administrative officer of the Institute at the pleasure of the Board. He shall devote his full time to the affairs of the Institute, unless otherwise authorized by the Board. The president may be removed, with or without cause, by the Board of Directors.

The president shall have the care and custody of all funds and securities of the Institute, subject to the direction and control of the Board of Directors. He shall keep, or cause to be kept, full and accurate accounts of receipts and disbursements and shall report thereon to the Board of Directors and to the members of the Institute from time to time, as directed by the Board.

B4.2.2 The president shall appoint a secretary and assistant secretaries, as necessary, from the staff of the Institute, with the approval of the Board of Directors. The secretary or a designated assistant secretary shall attend all meetings of the Board of Directors and shall be responsible for maintaining a record of the proceedings. The secretary shall be responsible for keeping all the records of the Institute. The president, the secretary, and the assistant secretaries shall be officers of the Institute, and may be authorized to sign contracts, checks, and other documents.

B4.2.3 The president shall annually submit a planning report to the Board of Directors through the Executive Committee which shall present the anticipated needs of ANSI including proposed organization changes and personnel and financial requirements necessary to improve operating effectiveness.

B5. Nomination and Election of Officers and Directors

B5.1 Nominating Committee. On or before June 1 of each year, the chairman shall appoint a Nominating Committee of not less than five members from the Board membership, subject to the approval of the Board of Directors.

B5.1.1 The Nominating Committee shall submit nominations for

(1) The office of chairman
(2) One vice-chairman
(3) Four directors from the slate proposed by organizational members
(4) Four directors from the slate proposed by company members
(5) One director proposed by the Consumer Interest Council
(6) One director-at-large
(7) Up to three directors to represent governmental members and other government organizations

B5.1.2 Proposals for nomination from the sources described shall be submitted to the president on or before September 1.

B5.2 Nomination by Petition

B5.2.1 Nominations may also be made by petition of four or more directors.

B5.2.2 Nominations for the office of director in a specified category, other than ex officio, may also be made by written petition signed by ten or more voting members of the Institute. Nominating petitions must be filed with the president of the Institute not later than October 15.

B5.3 Election of Officers. The Board of Directors shall elect the chairman and one vice-chairman at the last regular or special meeting of the Board held prior to the end of the fiscal year.

B5.4 Election of Directors. The president of the Institute shall prepare a letter ballot that will set forth all the nominations for directors made by the Nominating Committee and by petition. The letter ballot shall be mailed to the last known address of all voting members of the Institute on or before November 1. All ballots returned to the Institute on or before November 30 shall be counted, and the nominees receiving a plurality of the votes shall be elected. If prior to the annual meeting following the adoption of these Bylaws, it shall not be practicable to comply with the foregoing schedule of nominations and elections, the initial schedule shall be established by the Board of Directors by resolution.

B5.5 Vacancies. A vacancy in the office of chairman shall be filled by one of the vice-chairmen chosen by the Board of Directors for the balance of the unexpired term. Vacancies in the office of vice-chairman shall be filled by the Board of Directors from among its members for the balance of the unexpired term or terms. Vacancies in the office of elected directors representing specific categories shall be filled by the Board of Directors from the category of the director whose office has become vacant.

B6. Standing Committees of the Board

B6.1 Executive Committee. The Board of Directors shall have an Executive Committee composed of the following Board members: the chairman; the immediate past chairman (if willing to serve); the three vice-chairman; the chairmen of the Organizational Member Council, Company Member Council, and Consumer Interest Council; and four additional members of the Board of Directors appointed by the chairman and approved by majority vote of the entire Board. The Executive Committee is empowered to act for the Board of Directors between meetings of the Board to the full extent permitted by law, and shall present a report on any such actions to the Board. In no instance shall the Executive Committee take action inconsistent with prior resolutions of the Board.

B6.1.1 The Executive Committee shall provide guidance for the administration of ANSI. The president shall attend meetings of the Executive Committee but shall not have a vote.

B6.1.2 The Executive Committee shall be responsible for receiving and reviewing planning recommendations from the president and others. The president and Executive Committee shall report annually to the Board of Directors on these proposed future plans including, but not limited to, organization, facilities, staff, financial resources, communications, international activities, and relations with the United States Government.

B6.1.3 The Executive Committee shall be responsible for the compensation and benefits of the salaried officers. All personnel policies shall be reviewed and approved by the Executive Committee.

B6.2 Finance Committee. The Board shall have a Finance Committee under the chairmanship of a designated vice-chairman of the Board. This committee shall maintain a continuing review of the financial affairs of the Institute and make appropriate recommendations to the Board or the Executive Committee of the Board. It shall report to the Board of Directors at each meeting of the Board.

B7. Councils, Boards, and Committees of the Institute

B7.1 Organization and General Responsibilities. Each council, board, and committee of the Institute shall discharge the responsibilities set forth in this section and such further responsibilities as may be delegated to it by the Board of Directors.

B7.1.1 Members of all councils, boards, and committees, except the Organizational Member Council, Company Member Council, and the U.S. National Committee of the International Electrotechnical Commission, shall be appointed by the chairman of the Board, in consultation with the entity involved, and with the approval of the Board of Directors. Appointments shall be for a term of three years with no person serving more than three terms.

B7.1.2 Councils, boards, and committees shall present a written report to the Board of Directors on their activities from time to time and at least once each year.

B7.1.3 Each council, board, and committee shall prepare its own operating procedures, which shall be consistent with the Constitution and Bylaws of the Institute. These procedures shall become effective when approved by the Board of Directors. The Board may make changes in any of these operating procedures at any time, after consultation with or upon recommendation of the council, board, or committee concerned.

B7.1.4 Each council, board, and committee shall elect from among its members a chairman and a vice-chairman, who shall be nominated and elected in accordance with its operating procedures. Officers shall serve for one year, and shall be eligible for reelection for not more than three consecutive terms. A staff member of the Institute designated by the president shall serve as a nonvoting secretary of each council, board, and committee.

B7.1.5 Each council, board, and committee shall establish an executive committee, if appropriate, that shall be responsible for its administration between meetings. The chairman and vice-chairman of each council, board, and committee shall occupy the same positions on its executive committee. Unless otherwise specified in these Bylaws, the number of members of the executive committee, their method of selection, and the provisions for a quorum at meetings of a council, board, or committee and of its executive committee shall be prescribed in its procedures as approved by the Board of Directors.

B7.1.6 Each council, board, and committee may establish such additional committees, subcommittees, and boards as are considered necessary to accomplish its mission.

B7.1.7 Notice of the time and place of meetings of any council, board, and committee shall be given by its secretary. Notice shall be given by mail, telegraph, cable, or by delivery in person to each member at least seven days before the meeting. Attendance at the meeting shall be deemed waiver of notice. The notice shall include an agenda of the principal items to be considered, and action shall not be taken at any meeting on matters not specified in the agenda.

B7.2 Executive Standards Council. The Executive Standards Council shall be responsible, as set forth in the following provisions, for national and international standards activities of the Institute, except for approval or withdrawal of standards as American National Standards.

B7.2.1 The Executive Standards Council shall be composed of six representatives of organizational members, six representatives of company members, four representatives of governmental members, two members of the Consumer Interest Council, and three members-at-large.

B7.2.2 The Executive Standards Council's responsibilities shall include, but not be limited to:

(1) Being alert to the need for new standards or the reexamination of existing standards in the light of changing conditions.

(2) Developing and promulgating procedures and criteria for the coordination, development, approval, and withdrawal by the Institute of standards as American National Standards.

(3) In initiating standards projects, seeking action by an organization competent and accepted in the field, or jointly by two or more such organizations.

(4) Defining the scope of proposed standards projects and assigning administrative responsibility.

(5) Stimulating the work of organizations or committees engaged in the development or revision of standards to the end that such work is completed expeditiously and that standards are thus timely and adequate.

(6) Being watchful of the interests of those who may be affected by a particular standards activity so that their views are heard, a consensus is sought, and enterprise and initiative are encouraged.

(7) Continually reviewing and ensuring participation of the United States of America in pertinent international standards development activities.

(8) Except as otherwise specified in these Bylaws, establishing national coordinating committees, as required, to handle United States participation in the activities of international standardization organizations and approving the rules and procedures by which these committees are organized and operated.

(9) Providing a channel through which another council, board, committee, and any member or interested nonmember may request a review of any American National Standard.

B7.3 Board of Standards Review. The Board of Standards Review shall be responsible, as set forth in the following provisions, for approval and withdrawal of American National Standards and for other responsibilities that may be delegated to it by the Board of Directors.

B7.3.1 The Board of Standards Review shall be composed of not less then nine nor more than eighteen members. Vacancies in membership shall be filled for the remainder of the term by the chairman, with the approval of the Board of Directors.

B7.3.2 At any meeting of the Board of Standards Review, the presence of a majority of its members shall constitute a quorum.

B7.3.3 The responsibilities of the Board of Standards Review shall include, but not be limited to:

(1) Implementing procedures for the approval and withdrawal of standards as American National Standards and adjudicating questions or conflicts that develop in the standards approval procedure

(2) Determining whether standards submitted to the Institute for approval or withdrawal as American National Standards meet the requirements of the Institute, and acting on all requests for approval, reaffirmation, revision, and withdrawal of American National Standards

(3) Being watchful of the interests of those who may be affected by a particular standard so that their views are given full and adequate consideration

B7.3.4 The functions, duties, and responsibilities of the Board of Standards Review shall be further defined in its operating procedures.

B7.4 Audit and Accreditation Board. The Audit and Accreditation Board shall be responsible for the conduct of audits of the methods and procedures utilized by standards developing groups in developing and processing proposed American National Standards and for the accreditation of standards developing organizations.

B7.4.1 The Audit and Accreditation Board shall have a voting membership of not less than five nor more than nine individual members appointed by the chairman with the approval of the Board of Directors. Nominees for appointment to the Audit and Accreditation Board shall be qualified by background and experience to render impartial judgments.

B7.4.2 The responsibilities of the Audit and Accreditation Board shall include, but not be limited to:

(1) Developing operating procedures for: (a) the conduct of audits of methods and procedures used in developing evidence of consensus in the standards development process used by organizations, and (b) determining the qualifications of organizations to become accredited

(2) Administering the audit and accreditation programs

(3) Reviewing audit reports and taking appropriate action

(4) Interfacing with other boards and councils of the Institute

B7.5 International Standards Council. The Institute's responsibility for administrative policy in international standards is delegated by the Board of Directors to the International Standards Council. This responsibility includes administrative policy for the Institute's activities involving the International Electrotechnical Commission (IEC), International Organization for Standardization (ISO), and other international standardization organizations with which the Institute is or may become affiliated.

B7.5.1 The International Standards Council shall be composed of not less than fifteen nor more than thirty members representative of the broad interests of the Institute. Members shall be appointed by the chairman with the approval of the Board of Directors.

B7.5.2 The functions of the International Standards Council shall be as follows:

(1) Advising the Board of Directors concerning Institute membership in international standardization organizations and the basic policies and procedures for participation in international standardization activities

(2) Acting on behalf of the Institute in liaison with governmunt departments and agencies in the work of international treaty organizations to the extent that ANSI participation is requested, subject to approval by the Board of Directors

(3) Reporting annually to the Board of Directors on United States participation in international standardization activities

B7.6 U.S. National Committee of the International Electrotechnical Commission. The responsibility of the Institute for U.S. representation in IEC is delegated to the United States National Committee of the IEC (USNC). This responsibility shall be exercised by the Executive Committee of the USNC.

B7.6.1 The membership of the Executive Committee shall consist of the officers of the USNC, the chairman of the USNC/CEE (International Commission for Conformity Certification of Electrical Equipment), and individuals elected from the USNC by its entire membership, subject to approval by the Executive Standards Council.

B7.6.2 The USNC Executive Committee shall report to the Executive Standards Council for coordination of technical matters.

B7.6.3 Actions of the USNC Executive Committee shall be subject to appeals to the Executive Standards Council and to further appeals provided for in these Bylaws.

B7.6.4 The USNC shall be represented on the International Standards Council for purposes of policy coordination, in accordance with ANSI Bylaw B7.5.

B7.6.5 The functions of the USNC Executive Committee shall be as follows:

(1) Representing the U.S. in IEC and other electrotechnical bodies associated with IEC, on behalf of the Institute

(2) Coordinating related activities, such as those involving CEE

(3) Recommending to the Board of Directors an annual budget to cover IEC activities

(4) Managing programs and adjudicating disputes arising from authorized USNC activities

(5) Coordinating USNC activities with appropriate standards boards to promote consistency between those international and national activities that fall within the scope of IEC

(6) Reporting annually to the International Standards Council on U.S. participation in IEC activities

(7) Establishing, as appropriate, committees to cover U.S. participation in IEC activities

B7.6.6 Notwithstanding the provisions of Section B12 of these Bylaws, the USNC shall not be dissolved without its consent.

B7.7 Organizational Member Council. The Organizational Member Council shall represent the standardization interests of the organizational members in the activities of the Institute.

B7.7.1 The Organizational Member Council shall be composed of one representative of each organizational member.

B7.7.2 The Organizational Member Council's responsibilities shall include, but not be limited to:

(1) Cooperating with the Executive Standards Council in identifying needs for new standards or reexamining existing standards in the light of changing conditions

(2) Serving as a channel of communication for presenting to the Board of Directors the views of organizational members on the policies and programs of the Institute and assisting in implementing programs to attract an adequate and widely representative body of organizational members

(3) Submitting each year to the Nominating Committee of the Board of Directors a slate of candidates for membership on the Board to represent organizational members, as called for by B3.1 and B5.1.1

B7.8 Company Member Council. The Company Member Council shall represent the interests of commerce and industry in the activities of the Institute.

B7.8.1 The Company Member Council shall be composed of one representative of each company member.

B7.8.2 The Company Member Council's responsibilities shall include, but not be limited to:

(1) Advising the Board of Directors of the Institute on behalf of commerce and industry on policy, organization, and plans

(2) Serving as the channel of communication for presenting to the Board of Directors the views of company members on the policies and programs of the Institute

(3) Advising the Board of Directors of the Institute on policies and assisting in implementing programs to attract an adequate and widely representative body of company members

(4) Undertaking programs intended to support the Institute in its efforts to achieve recognition for its role in the national and international standards system. Initiating and supporting appropriate communications and cooperation with other councils and bodies of the Institute

(5) Submitting each year to the Nominating Committee of the Board of Directors a slate of candidates for membership on the Board to represent company members, as called for by B3.1 and B5.1.1.

B7.9 Consumer Interest Council. The Consumer Interest Council shall serve in educational, advisory, and coordinating capacities to maintain effective representation of consumers and to protect the interests of consumers in the activities of the Institute. The Consumer Interest Council shall stimulate the development and promote the use of consumer standards. It shall promote understanding by consumers of the proper function of standards and standardization.

For purposes of this council, a "consumer" is defined as a person who uses goods or services to satisfy his personal needs and desires rather than to resell them or to produce other goods or services with them.

B7.9.1 The membership of the Consumer Interest Council shall be composed of consumers, consumer representatives, representatives of general interests and and producers (including distributors and retailers) who are experienced and knowledgeable in the consumer field, and the director of the National Bureau of Standards or his designee.

B7.9.1.1 Membership in the Institute shall not be a requisite for membership on the Consumer Interest Council.

B7.9.1.2 It shall be the responsibility of the Board of Directors to maintain a reasonable balance between the classes of interest.

B7.9.2 The Consumer Interest Council's responsibilities shall include, but not be limited to:

(1) Serving as a channel of communication for presenting to the Board of Directors the views of consumer interests on policies and programs of the Institute

(2) Conducting, with the approval of the Board, such other activities it deems necessary; e.g., establishing and maintaining a committee to provide technical review of proposed consumer product/service standards; identifying consumer needs for consumer goods and services standards and making recommendations concerning those needs

(3) Serving, with the approval of the Board, as a contact between consumers, government, standards developing organizations, and industry in the area of standards for consumer goods and services, including the education of consumers regarding the activities of the Institute and the encouragement of consumer participation in these activities and in the activities of standards developing organizations

(4) Submitting each year to the Nominating Committee of the Board of Directors the name of one candidate to represent the Consumer Interest Council on the Board of Directors

B7.10 Certification Committee. The Certification Committee shall administer the authorized certification activities of the Institute.

B7.10.1 The Certification Committee shall have a voting membership of not less than six nor more than fifteen members appointed by the chairman with the approval of the Board of Directors. In making the appointments, the chairman shall endeavor to ensure representation of all interests concerned with certification and related activities.

B7.10.2 The responsibilities of the Certification Committee shall include, but not be limited to:

(1) Advising the Board of Directors and administering all national and international activities of the Institute in certification and related fields. In dealing with international certification programs, the Certification Committee will act in liaison with the International Standards Council and Executive Standards Council, as appropriate.

(2) Fostering the development of certification programs by others in response to a demonstrated need recognized by the Committee or a council of the Institute.

(3) Collaborating with government and private organizations in the development of criteria and systems for accrediting certification programs.

B7.10.3 Accreditation of certification programs by the Institute shall be subject to approval of the Board of Directors on recommendation of the Certification Committee.

B8. Indemnification

The Institute shall indemnify each of its officers and directors to the fullest extent permitted by the applicable laws of the State of New York. In addition each person who serves as an employee or as a voluntary member of any body of the Institute, or who serves voluntarily in any capacity at the express request of the Institute, shall be indemnified by the Institute against expenses reasonably incurred by such person in connection with any action, suit, or proceeding to which the person may be made a party by reason of such service, except in relation to matters for which such person shall finally be adjudged in such action, suit, or proceeding to be liable for negligence or misconduct in the performance of the person's duties. Expenses shall include the cost of reasonable settlement made with a view to curtailing litigation. Any settlement made shall be subject to the approval of the Institute. The foregoing right of indemnification shall not preclude the exercise of other rights to which such person may be entitled as a matter of law.

B9. Meetings

B9.1 **Annual Meeting.** The annual meeting of the Institute shall be held during the first quarter of the fiscal year at such time and place as may be determined by the chairman.

B9.2 **Organization and Regular Meetings of the Board.** The Board of Directors shall hold an organization meeting as soon as practicable after the commencement of the fiscal year. Regular meetings shall be held at least semiannually, upon not less than seven days' notice by the secretary concerning time and place.

B9.3 **Special Meetings.** Special meetings of the Institute, or of the Board of Directors, may be called by the chairman or the Executive Committee of the Board, or shall be called by the secretary on petition of twenty percent of the Board membership.

B9.4 **Notice of Meetings**

B9.4.1 The secretary shall mail a notice of the time and place of the annual meeting or of a special meeting of the Institute and a statement of purpose of any special meeting to each member not less than twenty days before such meeting. The notice shall include an agenda of the principal items to be considered, and action shall not be taken at any special meeting on matters not specified in the agenda.

B9.4.2 Notice of the time, place, and purpose of special meetings of the Board of Directors shall be provided by the president of the Institute, via mail, telegraph, cable, or by delivery in person to each member at least seven days before the meeting. Attendance at any such meeting shall be deemed waiver of notice. The notice shall include an agenda of the principal items to be considered, and action shall not be taken on matters not specified in the agenda.

B9.5 **Quorum.** At meetings of the Institute, the presence in person or by written proxy of at least one-fifth of the members of the Institute entitled to vote shall constitute a quorum.

B10. Fiscal Year

The fiscal year of the Institute shall be the calendar year.

B11. Parliamentary Procedure

On questions of parliamentary procedure not covered in these Bylaws, *Robert's Rules of Order* (latest edition) shall prevail.

B12. Amendments

Copies of amendments to these Bylaws, proposed through written petition by any ten members of the Institute or by any one member of the Board of Directors, shall be circulated by the secretary to each member of the Board of Directors at least thirty days before the meeting at which action is to be taken by the Board. If a proposed amendment receives approval by three-fourths of those present at any meeting of the Board, the secretary shall cause the proposal, with notice of the Board action, to be published in an official publication of the Institute, which is sent to all members. If, during the thirty-day period following publication, no objection in writing is received from a voting member of the Institute at the office of the Institute, the proposed change shall become effective at the end of such period. If an objection is received from a voting member during such period, the proposed change shall not be effective unless and until reaffirmed by a majority of the entire Board.

B13. Scope of Operations

The Institute shall develop principles for the formulation of standards and the operation of certification programs, but shall not itself formulate standards or operate certification programs.

B14. Appeals

The Board of Directors shall provide for an impartial appeals mechanism to handle appeals from any action of the Institute concerning the development, coordination, and approval of American National Standards.

Mr. **Brown** [presiding]. Thank you very much, Mr. Peralta.

Mr. O'Grady.

Mr. **O'Grady**. Thank you, sir.

Mr. Chairman and members of the subcommittee, ladies and gentlemen, ASTM is very pleased to again appear before this committee and to also commend this committee for its continuing interest in standards matters. There is probably no more popular issue on the Hill right at the moment than the issues of standards, certification, and accreditation as it relates not only to America but to the world taken as a whole.

I would like to address my comments in terms of the questions that were contained in the letter to me from Chairman Walgren dated July 11, and the first has to do with the role of ASTM in the development of international standards. There's a distinction that needs to be made here, ladies and gentlemen, that describes an international standard which is a standard which is developed by an international body and used internationally and a standard that is developed by an Americans standards body, such as ASTM, which, by virtue of its use, its demand, and its acceptance, is characterized as a de facto international standard.

Attached to this statement is a summary of ASTM participation in ISO activities. I think it's important to understand that when we first started to keep count of the committees that had active participation ISO we identified 50 committees which had such a participation. In the recent past, the number changed to 65, and as recently as a week or two ago the number is now over 70. So there is a clear commitment on the part of ASTM to support the International Standards Organization, and that comes about in part because the ASTM contribution to the world standards organization is because of its technical wealth.

The enormity of the system of ASTM, 135 technical committees, contribute mightily to the technical content of the standards that are produced in ISO and elsewhere, and many of the ISO standards are duplicates of that which have been produced by ASTM. There are other standards, for example, in petroleum and plastics that are recognized world-wide and are accepted as preferred standard of use—again, as we like to characterize it, de facto international standards.

The second question asked by Chairman Walgren dealt with EC-1992 standardization initiatives, international standardization, and U.S. participation. Well, we came back from a trip recently in Europe, as my colleague has been doing, and in our trip we visited West Germany, France, Great Britain, and ISO, and, as far as we are able to determine, Mr. Chairman, we have discovered that harmonized standards development is advancing at a relentless pace toward the European Community's goal of replacing national standards, national standards, to be used in commerce within the single market in Europe, and tomorrow I will be making a different and perhaps more complete statement on the European issue when I appear before an interagency panel at the Department of Commerce, but for the purpose of this meeting I have attached that statement to the record of this hearing.

Mr. **Brown**. It will be made a part of the record, Mr. O'Grady.

Mr. **O'Grady**. Thank you, Mr. Chairman.

Another aspect of the 1992 initiatives is that, to date, most of the standards that have been adopted as European norms have come from ISO standards, and ASTM committees involved in ISO work have begun to express the desire to explore—to explore obtaining funds from the Federal Government to support the work. I underline the word "explore;" it's only a possibility.

But if we were to draw logical conclusions from the three trends that I've just briefly described, we might say that certain American interests believe that they might be able to integrate American standards technology into the European regional standards body through ISO. Therefore, the desire to participate in ISO seems to be enlivened, the need greater. However, it's clear that the ability to fund this increased interest is not, at least at this time, growing in parallel.

The third issue that Chairman Walgren asked me to comment on involves the funding of international standards work. International standards work within ISO is costly; we all know that. Besides travel costs, there are administrative costs of processing correspondence; there are the costs of coordination of the U.S. position on ballot items and other general duties; there's the problem of meeting expenses, of secretarial support, the use of interpreters and consulting fees. These are significant cost items, Mr. Chairman.

The impetus for participation is provided by those for whom the need and the ability are greatest, and funding support is provided in much the same way. Funding may often come from industry sources, but occasionally Federal Government is the funder. We have had some experience in that area. However, there's no across-the-board budgeting principle, no private or public fund anywhere allocated to the general purpose of participation in ISO. Interest in support is, in fact, industry specific, and it is very often random.

And, finally, the last issue I'd like to address is the appropriate role of the Federal Government in international standardization activities. ASTM believes the Federal Government already plays an appropriate role in domestic and international standard activities at least within the ASTM system. The Federal Government is quite rightly represented. It contributes significant and in proper context, that is, in balance with all other interests.

Just a footnote on that. The Federal Government participation in ASTM, they play as equal partners, they have no more or no less power than any other group, such as manufacturers, consumers, and general interest.

However, there's another role far more important that is in practice in other countries and around the world, but it is not in our own Government policy of appropriations. I call your attention, Mr. Chairman and members of the committee, to the fact that the promotion of American standards in the international marketplace, from a Government perspective, is lacking.

You are aware of certain initiatives by other industrialized countries' standard setting bodies that promote the use of their standards in developing or newly industrialized countries. We have seen this assistance first-hand during the course of our travels, and we can tell you that it represents a spectacular commitment on the part of those nations, particularly our three most industrialized

European friends and colleagues, West Germany, France, and the U.K.

May we point out now that this commitment is not on their part to the establishment of the ISO presence, but it is their commitment to establish their national technologies, namely, those of DIN, AFNOR, and BSI. Upon completion of the single market, that commitment will be to the advancement of the European norms, the thing that we're all so concerned about at this time.

That leads to the final question. Why is it then that our European counterparts are so actively promoting their own standards around the world and committing themselves so readily to the work of ISO. It appears to be a bit of a dichotomy.

The answer, I believe, is because each has their own place in the different segments of the world market. That is why we see Germany in places like Argentina, we see them in China, and other parts of the world, and other countries are doing the same thing, and where one or both succeed the European interest succeeds as well. So it really doesn't matter whether they do it with their standards or with ISO standards, it's a no lose situation for them.

Let me suggest to you now, Mr. Chairman, that where economies are developing, the ISO standards fill many needs. Let me suggest further to you that in a highly industrialized nation it is a national standard or, in the case of Europe, the regional standard that very often fulfills the need. In all cases, the standard will reflect the demand of the marketplace.

We must not, therefore, limit ourselves to the viewpoint that strengthening the U.S. participation in ISO is the only way to effectively strengthen American technological presence in other economies; it is not. By this, we do not imply that the U.S. must not commit itself to ISO; we must, and the ASTM record speaks to that, I believe, eloquently.

But we ask you to consider the idea that we must promote both participation in international standardization and the advancement of American standardization into other economies. These activities are not mutually exclusive, they are complementary and represent a full view of the American potential to impact the world trading cycle. This proposal is not different from what is already happening with our colleagues in Europe.

We have before us many fine examples of Government promotion without intervention. All we need to do is look to our European neighbors. They find Government funding to promote participation in ISO appropriate. We can find no fault with this. In many instances, Government has left the development of standards to the standards makers—that is, the private sector—while promoting, financially and otherwise, the advancement of these standards into the world marketplaces. They have done this through Government-funded training program, through the stationing of standards experts in all parts of the world, they have done this through the gifts of documents, the gifts of translations, gifts of laboratory equipment, and in some instances they have made gifts of buildings to other parts of the world to promote their standards activities, and, by the way, promoting their standards activities, they are promoting the success of the industry that backs up those standards.

They have used Government backing and support to promote the benefits of standardization to their own industries through the use of seminars and television, so they've done a very admirable job, and I'd like to stop here long enough to say I commend them; I commend the DIN's, the AFNOR's, and the BSI's of the world for having taken the initiative to do what they have been able to do to promote their own industries.

Here in America, ASTM has done its job. It has used a system of voluntary full consensus to develop standards of integrity and quality that have achieved world-wide acceptance and recognition. No addition of a Government presence beside the one already inherent in the process that I described previously will produce a better standard.

ASTM has gone even farther in taking its standards on the road, so to speak. We have gone to South America, we've gone to Europe, we've gone to the Orient, we've paid our own way to promote the ASTM document and, in so doing, promote American technology. Our only business is selling standards, we have no other business, and I think we do it very well.

We are found in many ISO activities as well, as you will see from the record, but our efforts, as mighty as they have been, cannot begin to compete with other programs of advancement that we have seen around the world. If our Federal Government is concerned about our effectiveness around the world—and it should be—we ask, therefore, to think of the things that we have said today; in plain words, we have the act; what we need is the producer.

So I thank you, Mr. Chairman, for the opportunity to be here to answer your questions, if you have any, and to just restate for one more time for the record the ASTM plea that you do not neglect the ASTM product and the development and promotion of the ASTM product, the American product, to the developing countries of the world in parallel with that which is being done by ISO.

Thank you very much, Mr. Chairman.

[The prepared statement of Mr. O'Grady follows:]

TESTIMONY

of

JOSEPH G. O'GRADY
PRESIDENT
ASTM

INTERNATIONAL STANDARDIZATION: THE FEDERAL ROLE

July 25, 1989

United States House of Representatives

Subcommittee on Science,
Research and Technology

PREPARED STATEMENT OF JOSEPH G. O'GRADY
PRESIDENT OF ASTM

INTERNATIONAL STANDARDIZATION:
THE FEDERAL ROLE

UNITED STATES HOUSE OF REPRESENTATIVES
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

WASHINGTON, D.C., JULY 25, 1989

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

WE ARE PLEASED TO BE HERE AGAIN BEFORE THIS SUBCOMMITTEE, AND WE COMMEND YOU FOR YOUR CONTINUING INTEREST IN STANDARDS MATTERS. YOU HAVE ASKED US TO DISCUSS SEVERAL INTERNATIONAL STANDARDS ISSUES TODAY. WE SHALL ADDRESS EACH IN TURN:

1. THE ROLE OF ASTM IN THE DEVELOPMENT OF INTERNATIONAL STANDARDS.

   LET US BEGIN BY MAKING THE DISTINCTION BETWEEN STANDARDS THAT ARE DEVELOPED THROUGH AN INTERNATIONAL BODY SUCH AS THE ISO, AND STANDARDS THAT ARE DEVELOPED BY AN AMERICAN STANDARDS BODY BUT ARE, IN FACT, INTERNATIONAL STANDARDS BY REASON OF GLOBAL ACCEPTANCE, DEMAND, AND USE. THE DISTINCTION WILL BECOME MORE IMPORTANT AS WE DISCUSS THEIR FUNCTIONS.

   ATTACHED TO THIS STATEMENT IS A SUMMARY OF ASTM PARTICIPATION IN ISO ACTIVITIES. IT REQUIRES NO EXPLANATION, BUT IT DEMONSTRATES VERY CLEARLY OUR SUPPORT OF THE GENERAL CONCEPT OF INTERNATIONAL STANDARDIZATION AND SPECIFICALLY, OUR SUPPORT OF THE ISO. ASTM'S CONTRIBUTION TO THE WORLD STANDARDS ORGANIZATION IS ITS TECHNICAL WEALTH. THERE ARE MANY ISO STANDARDS DOCUMENTS THAT ARE MIRROR IMAGES OF THE ASTM DOCUMENT.

There are other ASTM standards, for example in the areas of petroleum and plastics, that are recognized, worldwide, as the accepted and preferred standard of use, or the "de facto" international standard.

2. EC 1992 Standardization Initiatives, International Standardization, and U.S. Participation.

Fresh from a trip to Europe where we called on the standards organizations of West Germany, France, the U.K., and the ISO, and as far as we can see, the trends seem to be as follows:

A. Harmonized standards development is advancing at a relentless pace toward the European Community's goal of replacing national standards to be used in commerce within the Single Market of Europe.

(Tomorrow we will be testifying before an interagency panel at the Department of Commerce. We will go into the issue of European standardization in greater detail. We have attached our statement to this testimony, for the record and for a more complete discussion of this very important matter.)

B. At this point, the majority of European Norms are taken from ISO standards, and

C. ASTM Committees involved in ISO work have begun to express the desire to explore obtaining funds from the Federal Government to support their work.

If we were to draw a logical conclusion from these three "trends," we might say that certain American interests believe they might be able to integrate American standards technology into the European regional standards body through the ISO.

THEREFORE, THE DESIRE TO PARTICIPATE IN ISO SEEMS TO BE ENLIVENED, AND THE NEED GREATER. HOWEVER, THE ABILITY TO FUND THIS INCREASED INTEREST IS NOT GROWING IN PARALLEL.

3. FUNDING OF INTERNATIONAL STANDARDS WORK.

INTERNATIONAL STANDARDS WORK WITHIN THE ISO IS COSTLY. BESIDES TRAVEL COSTS THERE ARE THE ADMINISTRATIVE COSTS OF PROCESSING CORRESPONDENCE, THE COORDINATION OF THE U.S. POSITION ON BALLOT ITEMS AND OTHER GENERAL DUTIES, MEETING COSTS, SECRETARIAL SUPPORT, INTERPRETERS, AND CONSULTING FEES.

THE IMPETUS FOR PARTICIPATION IS PROVIDED BY THOSE FOR WHOM THE NEED AND THE ABILITY IS GREATEST, AND FUNDING SUPPORT IS PROVIDED IN MUCH THE SAME WAY. FUNDING MOST OFTEN COMES FROM INDUSTRY SOURCES, BUT OCCASIONALLY THE FEDERAL GOVERNMENT IS THE FUNDER. THERE IS NO ACROSS-THE-BOARD BUDGETING PRINCIPLE, NO PRIVATE OR PUBLIC FUND -- ANYWHERE -- ALLOCATED FOR THE GENERAL PURPOSE OF PARTICIPATION IN THE ISO. INTEREST AND SUPPORT ARE INDUSTRY-SPECIFIC; AND IT IS RANDOM.

FINALLY, WE WILL ADDRESS THE LAST ISSUE REQUESTED OF US:

4. THE APPROPRIATE ROLE FOR THE FEDERAL GOVERNMENT IN INTERNATIONAL STANDARDIZATION ACTIVITIES.

WE BELIEVE THE FEDERAL GOVERNMENT ALREADY PLAYS AN APPROPRIATE ROLE IN DOMESTIC AND INTERNATIONAL STANDARDIZATION ACTIVITIES, AT LEAST WITHIN THE ASTM SYSTEM. THE FEDERAL GOVERNMENT IS QUITE RIGHTLY REPRESENTED, CONTRIBUTES MIGHTILY AND IN THE PROPER CONTEXT, THAT IS, IN BALANCE WITH ALL OTHER INTERESTS.

However, there is another role, far more important, that is in practice in other countries around the world, but not in our U.S. Government policy of appropriations. And that is the PROMOTION OF AMERICAN STANDARDS IN THE INTERNATIONAL MARKETPLACE.

You are aware of certain initiatives by other industrialized countries' standards-setting bodies that promote the use of their standards in developing or newly industrializing countries. We have seen this "assistance" firsthand during the course of our travels, and we can tell you that it represents a spectacular commitment on the part of these nations, particularly our three most industrialized European friends, West Germany, France, and the U.K. May we point out now, that this commitment is NOT to the establishment of the ISO technical presence, but it is to the establishment of national technologies, namely, those of DIN, AFNOR, and BSI. Upon the completion of the Single Market, that commitment will be to the advancement of European Norms.

Why is it then, that our European counterparts are so actively promoting their own standards around the world, and commit themselves so readily to the work of the ISO? BECAUSE THEY EACH HAVE THEIR PLACE IN THE DIFFERENT SEGMENTS OF THE WORLD MARKET. And where one or both succeed, the European interests succeed as well. Let me suggest to you now, that where economies are developing, the ISO standard fills many needs. Let me suggest to you further, that in highly industrialized nations, it is the national standard, or in the case of Europe, the regional standard, that fulfills the need. In all cases, the standard will reflect the demand of the marketplace.

We must not, therefore, limit ourselves to the viewpoint that the strengthening of U.S. participation in the ISO is the only way or the most effective way to strengthen the

AMERICAN TECHNOLOGICAL PRESENCE IN OTHER ECONOMIES. IT IS NOT. BY THIS, WE DO NOT IMPLY THAT THE U.S. MUST NOT COMMIT ITSELF TO THE ISO. WE MUST. BUT WE ASK YOU TO CONSIDER THE IDEA THAT WE MUST PROMOTE BOTH PARTICIPATION IN INTERNATIONAL STANDARDIZATION AND THE ADVANCEMENT OF AMERICAN STANDARDIZATION INTO OTHER ECONOMIES. THESE ACTIVITIES ARE NOT MUTUALLY EXCLUSIVE. THEY ARE COMPLEMENTARY, AND REPRESENT A FULL VIEW OF THE AMERICAN POTENTIAL TO IMPACT THE WORLD TRADE CYCLE.

WE HAVE BEFORE US MANY FINE EXAMPLES OF GOVERNMENT PROMOTION WITHOUT INTERVENTION. ALL WE NEED DO IS LOOK TO OUR EUROPEAN NEIGHBORS. THEY FIND GOVERNMENT FUNDING TO PROMOTE PARTICIPATION IN ISO ACTIVITIES APPROPRIATE. WE CAN FIND NO FAULT IN THIS. IN MANY INSTANCES, GOVERNMENTS HAVE LEFT THE DEVELOPMENT OF STANDARDS TO THE STANDARDS MAKERS, THAT IS, THE PRIVATE SECTOR, WHILE PROMOTING, FINANCIALLY AND OTHERWISE, THE ADVANCEMENT OF THESE STANDARDS INTO THE WORLD'S MARKETPLACES.THEY HAVE DONE THIS THROUGH GOVERNMENT-FUNDED TRAINING PROGRAMS, THROUGH THE STATIONING OF STANDARDS EXPERTS IN ALL PARTS OF THE WORLD, THROUGH THE GIFTS OF DOCUMENTS, TRANSLATIONS, LABORATORY EQUIPMENT, AND YES, EVEN BUILDINGS. THEY HAVE USED GOVERNMENT BACKING AND SUPPORT TO PROMOTE THE BENEFITS OF STANDARDIZATION TO THEIR OWN INDUSTRIES, THROUGH THE USE OF SEMINARS AND TELEVISION.

HERE IN AMERICA, ASTM HAS DONE ITS JOB. IT HAS USED THE SYSTEM OF VOLUNTARY, FULL CONSENSUS TO DEVELOP STANDARDS OF INTEGRITY AND QUALITY THAT HAVE ACHIEVED WORLDWIDE ACCEPTANCE AND RECOGNITION. NO ADDITION OF A GOVERNMENT PRESENCE, BESIDES THE ONE ALREADY INHERENT IN THAT PROCESS, WILL PRODUCE A BETTER STANDARD.

ASTM HAS GONE EVEN FARTHER AND HAS TAKEN ITS STANDARDS "ON THE ROAD," SO TO SPEAK. WE HAVE GONE TO SOUTH AMERICA, TO EUROPE AND TO THE ORIENT, ON OUR OWN, TO PROMOTE THE ASTM

> DOCUMENT, OR, IF YOU WILL, AMERICAN TECHNOLOGY. WE ARE FOUND IN MANY ISO ACTIVITIES AS WELL. BUT OUR EFFORTS, AS MIGHTY AS THEY HAVE BEEN, CANNOT BEGIN TO COMPETE WITH OTHER PROGRAMS OF ADVANCEMENT WE HAVE SEEN. IF OUR FEDERAL GOVERNMENT IS CONCERNED ABOUT OUR EFFECTIVENESS AROUND THE WORLD, AND IT SHOULD BE, WE ASK IT, THEREFORE, TO THINK ABOUT THE THINGS WE HAVE SAID HERE TODAY. IN PLAIN WORDS, WE HAVE THE ACT. WHAT WE COULD USE IS A PRODUCER.

THANK YOU, MR. CHAIRMAN. WE APPRECIATE THE EFFORT YOU HAVE MADE TO HOLD THIS HEARING TODAY, AND WE ARE GRATIFIED BY YOUR AWARENESS OF THE IMPORTANCE OF STANDARDS TO OUR AMERICAN INDUSTRIES, OUR AMERICAN CONSUMERS, OUR AMERICAN GOVERNMENT, AND OUR AMERICAN WAY OF LIFE. THANK YOU VERY MUCH. I WOULD BE PLEASED TO ANSWER ANY QUESTIONS.

PARTICIPATION OF
ASTM - U.S. TAGS IN ISO ACTIVITIES
ASTM - TECHNICAL ADVISORS FOR IEC

72-TOTAL NO. OF TAGS
10-TOTAL NO. OF ASTM SECRETARIES
1379-TOTAL NO. OF PARTICIPATING

MEMBERS
* ASTM - Secretariat
"P" Participating Member
"O" Observer

ISO - International Organization for Standardication
IEC - International Electrotechnical Commission
TAC - Technical Advisory Group for ISO

JULY 1989

Voting Status	ISO TC/SC	Approx Year	TITLE	Secretariat (Country)	Staff Manager	TAG Affiliation	TAG Chairman	No. Participating Members
P	5/1	74	Steel Tubes	Switzerland	E. Sullivan	Special USA	E. A. Jones	8
P	8	47	Shipbuilding/Marine Structures	Netherlands	K. Schaaf	F25.80	C. H. Piersall	10
P	17	50	Steel	Japan(JISC)	E. Sullivan	A01.95	S. E. Tyson	40
*P	17/12	68	Steel Sheet	USA-ASTM	E. Sullivan	A01.95	E. Schuerer	9
P	17/SC1	69	Steel - Chem Analy	Japan	T. Mecholsky E. Sullivan	E03.01 Tag Group	R. Smith	20
O	18	55	Zinc & Zinc Alloys	Belgium(IBN)	R. Dougherty	B02.04	P. Jensen	5
	20/11		Aircraft & Space Vehicles	Canada	R. Dougherty	B02.92	J. Tackett	
P	24/2	78	Test Sieving	USA-ASTM	K. Schaaf	E29.03	C. Ward	17
O	25	50	Cast Iron	U.K.	G. Luciw	A04.92	N. Lillybeck	1
P	26	52	Copper & Copper Alloys (Specifications)	W. Germany	G. Luciw	B05.95	G. C. Vantilburg	30
P	26	52	Copper & Copper Alloys (Test Methodology)	W. Germany	T. Mecholsky	E03.05.03	A. Cardinal	30
P	27	50	Solid Mineral Fuels	U.K.	R. Dougherty	D05.27	R. Morlock	15
P	28	50	Petroleum Products	USA	E. Sullivan	ANSI	C. W. Siegmund	20
P	33	75	Refractories	U.K.	J. Holliday	C08.91	L. Trostel	18
P	34/12	76	Sensory Analysis	France	K. Schaaf	E18.05	T. Benson	11

Voting Status	ISO TC/SC	Approx Year	TITLE	Secretariat (Country)	Staff Manager	TAC Affiliation	TAC Chairman	No. Participating Members
O	35	55	Paint & Varnishes	Netherlands	D. Bradley	D01.06	J. Weaver	2
P	38	55	Textiles (Sponsors:	U.K.	B. Moran	D13.99	A. Delmar	73
*P	38/5	55	Yarn Testing	USA-ASTM	B. Moran	D13.99	D. Gentry	12
P	38/21	-	Geotextiles	USA-ASTM	J. Hyde	D35	R. Froebel	-
P	43/2	72	Building Acoustics	Denmark	S. Mawn	E33.06	R. Guernsey	27
P	45	48	Rubber	U.K.	T. Mecholsky	D11.45	E. S. English	30
P	47/7	75	Alumina	Italy	T. Mecholsky	E03.16.06	C. Davis	15
O	50	55	Lac	India	D. Bradley	D01.06	J. Weaver	2
P	59/3	87	Building Construction	U.K.	D. Bradley	E06.25.95	G. Davis	23
O	59/8	81	Jointing Seals	W. Germany	R. Malcolm	C24.87	L. Toporcer	33
P	61	48	Plastics	ANSI	B. Morgan	D20.61	D. Keeler	26
P	65	76	Manganese & Chromium Ores	USSR	T. Mecholsky	E03.16.08	J. Cline	15
O	71	68	Concrete, Reinforced Concrete	Austria	S. Orthey	C09.01.05	B. Mather	14
P	79	35	Light Metals & Their Alloys	France	S. Orthey	B07.09	G. H. Hsu	4
P	83/3	75	Ski Bindings	W. Germany	P. Loughran	F27.83	E. Bahniuk	7
P	83/4	75	Skis	Austria	P. Loughran	F27.83	E. Pilpel	5
P	83/5	87	Ice Hockey	Canada	J. Holliday	F08.15	C. Castaldi	8
P	91	70	Surface Active Agents	France	B. Moran	D12.33	S. Holoman	20
P	92	70	Fire Tests on Building Materials	U.K.	P. Loughran	E05.34	H. Roux	15

Voting Status	ISO TC/SC	Approx Year	TITLE	Secretariat (Country)	Staff Manager	TAG Affiliation	TAG Chairman	No. Participating Members
P	102	63	Iron Ores	Japan	T. Mecholsky	E03.16.05	F. Pennington, Jr.	25
*P	102/3	63	Physical Testing of Iron Ores	USA-ASTM	T. Mecholsky	E03.16.05	F. pennington, Jr.	25
P	107	63	Metallic & Other Non-Organic Coatings	Italy	P. Loughran	B08.20	A. Grobin	15
P	119	66	Powder Metallurgy	Sweden	G. Luciw	B09.09	W. Buerkel	30
O	120	68	Leather	Iran	B. Moran	D31.91	Not Active	None
P	121	83	Anesthesia & Respiratory Equipment	USA/Canada	B. Moran	F29.01-.07	J. Hedley-Whyte	40
P	129	72	Aluminum Ores	France	T. Mecholsky	E03.16.06	C. Davis	20
P	132	69	Ferroalloys	USSR	E. Sullivan	A01.30	P. D. Deeley	8
P	135	70	Nondestructive Testing	USSR	G. Luciw	E07.91	L. Mordfin	40
*P	135/3	70	Acoustic Methods	USA-ASTM	G. Luciw	E07.91	D. Eitzen	40
P	138	74	Plastic Pipe & Fittings	Netherlands	G. Luciw	F17.38	I. DeBleu	30
P	146	72	Air Quality	W. Germany	G. Luciw	D22.09	C. Matthews	35
P	146/2	72	Workplace Atmospheres	USA-ASTM	G. Luciw	D22.09	M. Kennebeck	35
P	146/3	72	Ambient Air Methods	USA-ASTM	G. Luciw	D22.09	J. Clements	35
P	147	72	Water Quality	USA-ANSI	J. Vowell	ANSI	A. Harvey	23
P	147/5	86	Aquatic Toxicology	AFNOR	A. McKlindon	E47.10	R. Purdy	18
P	150	72	Implants for Surgery	W. Germany	J. Holliday	F04.93	M. Mayor	20
P	150/1	72	Orthopaedic Implants	W. Germany	J. Holliday	F04.93.01	M. Mayor	15
*P	150/3	72	Neurosurgical Implants	W. Germany	J. Holliday	F04.93.03	R. Eisele	10

Voting Status	ISO TC/SC	Approx Year	TITLE	Secretariat (Country)	Staff Manager	TAC Affiliation	TAC Chairman	No. Participating Members
O	152		Gypsum	France	J. Vowell	C11 Exec.	G. Erwin	None
P	155	73	Nickel & Nickel Alloys	Canada	R. Dougherty	B02.92	J. Tackett	15
*P	155/2	73	Wrought & Cast Nickel & Nickel Alloys	USA-ASTM	R. Dougherty	B02.92	J. Tackett	15
*P	155/4	73	Methods of Analysis of Nickel Alloys	Canada	R. Dougherty	B02.92	J. Tackett	15
	155/4	73	Nickel Analysis		T. Mecholsky	E03.05.08	F. Blair	20
P	156	75	Corrosion of Metals	USSR	B. Moran	G01.95	S. Dean	30
*P	156/6	75	Evaluation & Treatment of Results of Corrosion Tests	USA-ASTM	B. Moran	G01.95	S. Dean	10
P	157	75	Mechanical Contraceptives	Sweden	T. Mecholsky	D11.57	M. Geiger ,	19
P	163	76	Thermal Insulation	Sweden	R. Morgan	C16.16	R. Tye	7
P	164	76	Mechanical Testing of Metals	Japan	S. Orthey	E28.94	J. A. Millane	15
*P	164/4	76	Toughness Testing	USA-ASTM	S. Orthey	E28.94	R. H. Lamothe	15
*P	166/1	77	Ceramic Ware-Release of Toxic Materials	USA-ASTM	D. Bradley	C21.92	M. G. McLaren	14
P	180		Solar Energy	Australia	D. Viall	E44	G. Zerlaut	
P	183	83	Non-Ferrous Ores	Australia	T. Mecholsky	E03.16.09	Q. Schmidt	20
P	184/SC^2	85	Robotics (Indirect) RIA	France	T. Mecholsky	F28	J. Bloodgood	10
P	187	83	Color Notations	Sweden	S. Kauffman	E12.07	W. H. Hale	20
P	7	65	Bare Aluminum Conductors	Canada	J. Holliday	B01.07	R. Breuer	62

Status	IEC	Year	TITLE	(Country)	Manager	Affiliation	Chairman	No. Participating Members
P	10	67	Liquid & Gaseous Dielectrics	Belgium	J. Vowell	D27.08	E. Morrison	15
P	15	68	Insulating Materials Electric	Italy	H. Greene	D09.91	H. Reymers	26
P	48	88	ISO/TC 48/SC 1-5	W. Germany	H. Greene	E41.10	A. Fuller	24
P	68	70	Magnetic Alloys & Steels	W. Germany	J. Holliday	A06 Main	A. Von Holle	54

DD/df
ISO-ACT

TESTIMONY

of

JOSEPH G. O'GRADY
PRESIDENT
ASTM

EC 1992 STANDARDS, TESTING AND CERTIFICATION HEARING

July 28, 1989

United States Department of Commerce

PREPARED STATEMENT OF JOSEPH G. O'GRADY
PRESIDENT OF ASTM

EC 1992 STANDARDS, TESTING AND CERTIFICATION HEARING

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON, D.C., JULY 26, 1989

WE ARE PLEASED TO ASSIST THIS BODY TODAY AS IT EXAMINES ISSUES SURROUNDING STANDARDS-RELATED ACTIVITIES WITHIN THE EUROPEAN COMMUNITY. WE ARE HERE TO SHARE OUR EXPERIENCES WITH YOU AND HOPE THEY WILL CONTRIBUTE TO THE ESTABLISHMENT OF THE APPROPRIATE AND MUTUALLY BENEFICIAL RELATIONSHIP THAT WE MUST ACHIEVE WITH OUR EUROPEAN COLLEAGUES AND TRADING PARTNERS.

BEFORE WE BEGIN, IT IS IMPORTANT THAT YOU UNDERSTAND OUR REMARKS IN THE PROPER CONTEXT AND, THEREFORE, WE MUST STATE OUR PERSPECTIVE.

1. ASTM IS FIRST, FOREMOST, AND LAST, A DEVELOPER OF VOLUNTARY STANDARDS.

2. ASTM PUBLISHES AND DERIVES VIRTUALLY ALL OF ITS INCOME FROM THE SALE OF THESE STANDARDS DOCUMENTS, AND OTHER RELATED TECHNICAL INFORMATION.

3. ASTM, AS A FULL CONSENSUS ORGANIZATION, AND AS AN ORGANIZATION OF VOLUNTEERS IS, AND MUST BE, RESPONSIVE TO THE INTERESTS AND NEEDS OF ITS CONSTITUENTS, THOSE WHO ACTUALLY WRITE THE STANDARDS. WE HAVE NO OTHER ROLE.

WE ARE AWARE OF THE TREMENDOUS IMPACT THE USE OF OUR STANDARDS HAS ON THE INTEGRITY AND QUALITY OF PRODUCTS, AND ON THEIR ABILITY TO AFFECT THE TRADE CYCLE. WE ARE AWARE, AS WELL, OF THE EVENTS TAKING PLACE IN EUROPE, BUT WE ARE NOT ANALYSTS OF FOREIGN TRADE POLICY AND WE WILL CONFINE OURSELVES TODAY TO THOSE AREAS WHERE WE CAN SPEAK FROM EXPERIENCE AND SOLELY FROM THE POINT OF VIEW OF THE STANDARDS DEVELOPER AND PUBLISHER.

WE HAVE BEEN TO EUROPE AND AROUND THE WORLD MANY TIMES OVER THE PAST FEW YEARS. WE HAVE GONE ABROAD WITH ONE THING IN MIND -- THE PROMOTION OF THE USE OF OUR STANDARDS IN OTHER MARKETPLACES. WE HAVE DEVELOPED GOOD WORKING RELATIONSHIPS WITH OUR COUNTERPARTS, THE OTHER STANDARDS ORGANIZATIONS, IN MANY COUNTRIES OF THE WORLD. FOR IN THE END, THEY MUST BE WILLING PARTNERS IN THE INTEGRATION OF OUR STANDARDS INTO THEIR ECONOMIES.

NOW THAT WE HAVE, HOPEFULLY, MADE IT CLEAR WHERE WE ARE COMING FROM, WE'D LIKE TO SHARE SOME OF OUR EXPERIENCES AND OBSERVATIONS, ESPECIALLY SINCE WE ARE FRESH FROM A TRIP TO EUROPE. OUR VISITS WERE TO OTHER STANDARDS ORGANIZATIONS, AMONG THEM THE ISO, THE BRITISH STANDARDS INSTITUTION; AFNOR, THE STANDARDS ORGANIZATION OF FRANCE; AND DIN, THE STANDARDS ORGANIZATION OF WEST GERMANY.

OUR UPDATE ON EUROPEAN STANDARDIZATION INCLUDED THE FOLLOWING OBSERVATIONS:

- THE HOPED-FOR TARGET OF HARMONIZED EUROPEAN STANDARDS BY 1992 IS 3,000 - 5,000 STANDARDS; BY THE CHANGE OF THE CENTURY, 8,000 - 9,000.
- IN 1980 THERE WERE 492 EUROPEAN NORMS; IN 1988 THERE WERE 1,127.

- In 1980 there were 210 European standards projects; in 1988 there were 2,641.

- European building codes, called Eurocodes, are already in draft. The replacement of national building codes will probably take about five years.

- In the last four years, CEN had doubled the number of its committees and increased its projects by ten times.

- The areas where standardization in CEN are concentrated are those where regulation will occur. That comprises about 60% of the standardization efforts at the moment. The rest are industry-related.

se are just a few facts which need no analysis. However, let's
te the obvious for the record: Harmonized standards develop-
t is advancing at a relentless pace toward the European
munity's goal of replacing national standards to be used in
merce within the single market of Europe. One might also say
t these standards are directed quite purposefully toward regu-
ory applications.

me now state ASTM's position regarding European standardiza-
n -- the process. Quite simply, we will make no effort to
erfere with, nor to change the system of, European standard-
tion. We have made no request for observer status, nor have
asked for exceptions to their present practices. We see no
son to discourage others who have the need to do so, even our
industry members, but that will not be the position of ASTM,
Society. There are lots of reasons for this, but let's state
one here that we think makes the most sense -- it isn't
ctical. Practically every nation on earth has asked for

OBSERVER STATUS IN CEN AND THE ANSWER TO ALL HAS BEEN "NO." THEY HAVE SAID, TIME AND TIME AGAIN, THAT THEY WILL NOT RECREATE THE ISO IN BRUSSELS AND WE BELIEVE THEM. WE SEE NO REASON TO DIRECT OUR ENERGIES IN PURSUIT OF A GOAL THAT SEEKS TO ALTER A PROCESS THAT IS AT LEAST HALF-WAY THROUGH ITS FIRST GREAT BODY OF WORK.

AS WE LOOK TO OUR FUTURE IN EUROPE, WHAT DO WE SEE? AT THIS POINT, NOTHING IS ABSOLUTELY CLEAR, BUT WE CAN MAKE THE FOLLOWING OBSERVATIONS:

IN TECHNICAL REGULATIONS, THE EUROPEAN NORM WILL BE THE VOLUNTARY STANDARD THAT BECOMES THE MANDATORY ONE, JUST AS ASTM STANDARDS BECOME MANDATORY WHEN CITED IN A BUILDING CODE. IN MOST INSTANCES TO DATE, THE BASIC STARTING POINT FOR EUROPEAN NORMS HAS BEEN THE APPROPRIATE ISO DOCUMENT. FOR EUROPEAN FIRMS EXPORTING TO THE UNITED STATES, THE ASTM STANDARDS ARE STILL THE DOCUMENT OF TRADE. FOR AMERICAN FIRMS EXPORTING TO EUROPE, THE EN WILL BE THE DOCUMENT OF TRADE. SO FAR, SO GOOD -- PROVIDING A PROPER BALANCE OF TRADE IS ACHIEVED AND PROVIDING THAT THERE IS A FAIR EXCHANGE OF THE USE OF AMERICAN AND EUROPEAN TECHNOLOGY. FOR WE HAVE SAID ALL ALONG, AND WE BELIEVE, THAT ASTM STANDARDS WILL STAND ON THEIR OWN IN ANY SYSTEM PROVIDED THEY CAN COMPETE FAIRLY IN A MARKETPLACE THAT IS FREE TO CHOOSE. WHERE WE MUST DIRECT OUR ATTENTION, THEREFORE, AND YOURS, IS NOT TO THE STANDARDS-SETTING PROCESS BUT TO THE PRACTICE OF CERTIFICATION OR AS IT WILL PROBABLY BE CALLED, THE EUROPEAN "QUALITY POLICY." WE HAVE ALWAYS CONTENDED THAT, GENERALLY SPEAKING, STANDARDS ARE NOT BARRIERS TO TRADE -- REGULATIONS ARE. THIS IS WHERE OUR SPHERE OF INFLUENCE ENDS AND YOURS BEGINS -- AT THE POINT OF REGULATION. AS YOU CONTEMPLATE U.S. POLICY ISSUES, WE ASK YOU TO CONSIDER NOT THE STANDARDS THEMSELVES, BUT HOW THEY WILL BE USED.

WE BELIEVE SOME SERIOUS DIFFERENCES EXIST BETWEEN THE POWERS OF THE EUROPEAN COMMUNITY AS TO HOW THE TESTING, ACCREDITATION AND CERTIFICATION GUIDELINES WILL BE STRUCTURED, FOR THESE ISSUES ARE

R MORE COMPLICATED THAN STANDARDS-SETTING. WE ALSO BELIEVE
AT PROGRESS ALONG THESE LINES WILL BE A BIT SLOWER BUT THAT
EY WILL BE FORTHCOMING, NONETHELESS, FOR THEY MUST BE TO BRING
OUT THE MARKET TO WHICH OUR EUROPEAN COLLEAGUES ARE SO
MITTED.

TH RESPECT TO THE ISSUE OF EUROPEAN CERTIFICATION, WE URGE YOU
STUDY THIS ISSUE CAREFULLY AND TO FOLLOW ITS PROGRESS, FOR IT
IN THIS ISSUE AND HOW IT IS RESOLVED THAT OUR FUTURE, THE
TURE OF ASTM STANDARDS AND AMERICAN TECHNOLOGY, LIES. IT IS IN
S ISSUE THAT THE FUTURE SUCCESS OF AMERICAN BUSINESS ABROAD IS
D. IN THAT REGARD WE ARE HERE TO COMMIT OUR SOCIETY TO AID
S PANEL, TO ADVISE AND TO SHARE OUR UNDERSTANDING OF THESE
UES, AS THEY RELATE TO OUR OWN SUCCESS IN THE EUROPEAN MARKET
IN THE WORLD MARKET.

RNESS IS WHAT WE MUST ACHIEVE WITH OUR EUROPEAN COLLEAGUES.
CANNOT ACCEPT A CONDITION WHEREIN OUR TECHNOLOGY IS LEGISLATED
OF USE IN THE SINGLE MARKET, WHILE THE AMERICAN MARKET
AINS COMPLETELY OPEN AND RECEPTIVE TO EUROPEAN TECHNOLOGY.

TERDAY I APPEARED BEFORE A CONGRESSIONAL PANEL AND OUTLINED
THER INTERNATIONAL STANDARDS ISSUE, WHICH IS NOT UNRELATED TO
EUROPEAN SITUATION UNDER CONSIDERATION TODAY. I OFFER IT TO
, FOR THE ISSUES CONTAINED IN IT ARE RELEVANT IF NOT EUROPE-
CIFIC.

NK YOU FOR YOUR TIME.

OULD BE PLEASED NOW TO ANSWER QUESTIONS.

Mr. **Brown**. Thank you, Mr. O'Grady.

I'm going to have to recess the Committee, I hope very briefly, the chairman should be returning from voting, and then we will take up Ms. Wood.

The Committee will be in recess.

[Recess.]

Mr. **Walgren**. Let me call us back to order, and we'll proceed with Ms. Wood.

Ms. **Wood**. Thank you, Mr. Chairman.

with your earlier encouragement, I will summarize my statement and submit the full statement for the record.

Standardization is a major interest to the members of the IEEE Computer Society. We are therefore pleased to address the important issue of the Federal role in international standardization.

My name is Helen Wood. I am president elect of the Computer Society of the Institute of Electrical and Electronics Engineers, the IEEE. I'm also an employee of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. However, my testimony today is strictly on behalf of the IEEE Computer Society and in no way intended to reflect the views of NOAA or the Department of Commerce.

The IEEE is the largest technical professional society in the world, with nearly 300,000 members world-wide, a quarter of a million of whom are in the United States and involved in a broad and growing range of electro-technologies. Through its predecessor organizations, the IEEE has been involved in the development of standards for over 100 years.

The Computer Society is a technical society of the IEEE. It is the world's largest organization of computing technology professionals, with over 100,000 total members, nearly 75,000 of whom are in the United States. Draft standards developed under Computer Society sponsorship are forwarded to the IEEE for adoption. Upon approval, they are submitted to the American National Standards Institute for adoption.

The Computer Society's Standards Program has grown very quickly, from a small handful of volunteers working in a rather obscure area of terminology standardization in the seventies to nearly 5,000 participants involved in over 180 standards projects, and while the number may seem rather small, these technical specifications are highly complex.

Our activities include and address areas such as local area networking, microprocessors, software portability, and computer security. These standards have widespread effects on products and practices throughout all sectors of the global economy. For example, our POSIX family of standards defines an environment that permits applications software to run on computer systems from many different vendors.

Standards developed under Computer Society sponsorship have received strong international support. We believe that this support may have been boosted by the amount of international participation that takes place during the development of the standards within our Computer Society working groups.

A number of Computer Society-sponsored standards have been adopted as international standards. For instance, the local area

etworking standards have become part of the open systems inter-
onnection standards in ISO.

We believe that the current level of limited Federal participation
n the international standards activities hinders the effective repre-
entation of all U.S. interests in that process. For example, over
he years the Federal Government has played a substantial role in
he development of U.S. information technology standards, often as
he only representative of the interests of users or consumers of
omputer and communications technology.

When these standards that were developed initially in the
nited States were adopted internationally, U.S. interests, we be-
eve, were well served, but today, as you know, many of the infor-
ation technology standards are first developed within the inter-
ational process. This approach tends to discourage the develop-
ent of differing national standards, which is an advantage in that
ese standards, if different, could impede free trade. However, the
gher costs of international travel, coupled with tightening Feder-
budgets, have made it extremely difficult for the Government to
ovide needed support for high priority standards areas.

Since the Government, as I mentioned, is often the only repre-
ntative of user interests in these committees, the voices of tech-
logy users, if the Government is absent, are often totally absent
om key discussions. Further, when U.S. delegations are mostly
ade up of vendors, they are often received with suspicion by for-
n delegations. This reaction further complicates an already diffi-
lt negotiation process.

We believe that ANSI serves a very important role with respect
U.S. interests in international standardization. As the member
dy representing the U.S. in both the ISO and the IEC, ANSI co-
linates U.S. participation in these activities. Operationally, this
quires handling mountains of paper documents, coordinating the
eparation of position papers, votes, technical contributions, and
ch, much more. To effectively carry out these duties indeed re-
res knowledgeable, dedicated staff and ever increasing financial
ources.

Ve have observed that funding shortfalls or difficulty in keeping
with the requirement for financial resources has hindered
SI's effectiveness in meeting some of its obligations, especially
the information technology area. Recently, however, ANSI has
en steps to improve its support for international information
nnology standards. A new oversight committee has been formed,
funding is being raised from participating organizations. The
ults of these improvements have been encouraging.

n conclusion, we note that for U.S. interests to be effectively
resented in international standards activities, at least two crite-
must be met. First, the interests of both vendors and users
st be well represented; and, second, adequate resources—and by
we mean not just funding but people, must be provided for ad-
istrative and technical support of these activities.

o accomplish these objectives, we believe an expanded Federal
in international standardization should be defined, accompa-
by the increased funds needed to fulfill that role. We believe
the mission of the National Institute of Standards and Tech-
gy is well suited to providing Federal leadership in internation-

al standards activities. However, an expanded Federal role, we believe, should complement and not replace the valuable role performed by ANSI.

The NIST and possibly other Federal agencies would require some additional funding to increase Federal participation in high priority international standards activities. For over two years, the IEEE has called for steps to increase the overall budget of the NIST. There can be little doubt, in our opinion, why the international competitive position of the United States continues to decline when the Federal Government does not adequately support its own standards role.

Effective Federal participation in international standards activities, we believe, will provide double benefits. The Government will develop the standards needed for its own cost-effective operation, and, at the same time, the overall effectiveness of U.S. participation in international standards will be improved.

We are pleased to have been able to share our views on this important subject and would be happy to assist in any other way that we can.

[The prepared statement of Ms. Wood follows:]

IEEE
COMPUTER
SOCIETY
a member society
of the IEEE

STATEMENT OF HELEN M. WOOD, PRESIDENT-ELECT

IEEE COMPUTER SOCIETY

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

JULY 25, 1989

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IEEE
THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

INTRODUCTION

Mr. Chairman, Mr. Boehlert and Members of the Subcommittee: Effective representation of U.S. interests in high priority, international standardization activities is essential for the competitiveness of our nation in international markets. Standardization is of major interest to the members of the IEEE Computer Society. We are therefore pleased to address the important issue of the federal role in international standardization.

My name is Helen Wood, and I am president-elect of the Computer Society of the Institute of Electrical and Electronics Engineers (IEEE). I am also an employee of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, where I direct the real-time processing of data from NOAA's meteorological satellites. However, my testimony today is strictly on behalf of the IEEE Computer Society, and in no way is intended to reflect the views of NOAA or the Department of Commerce.

BACKGROUND

The IEEE is the largest technical professional society in the world, with almost 240,000 members in the United States who are engaged in advancing the frontiers of knowledge and supporting the public with a broad and growing range of electrotechnologies. Through its predecessor organizations, the IEEE has been involved in the development of electrotechnical standards for over 100 years.

The Computer Society, a technical society of the IEEE, is the world's largest organization of computing technology professionals, with over 100,000 total members and nearly 76,000 members in the United States. Draft standards developed under Computer Society sponsorship are forwarded to the IEEE for adoption. Upon approval by the IEEE, they are submitted to the American National Standards Institute (ANSI) for recognition as American National Standards. A number of Computer Society-sponsored standards have been adopted by the International Standards Organization (ISO) and the International Electrotechnical Commission (IEC).

COMPUTER SOCIETY ROLE IN U.S. STANDARDS

From a handful of volunteers in the late 1970's, the Computer Society's standards program has grown to nearly 5,000 participants involved in over 180 standards projects. Computer Society standardization activities address software engineering, local area networks, microprocessors, design automation, test technology, applications software portability, terminology, security, and programming languages. These standards have widespread effects on products and practices throughout all sectors of the global economy. For example, IEEE 802 standards for local area networks have been adopted by the ISO as part of the Open Systems Interconnection (OSI) family of standards. IEEE 1003 POSIX standards define a portable applications environment that permits applications software to run on systems from many different vendors. The first of the POSIX standards has been approved as a draft international standard by a joint ISO/IEC standards committee.

Standards developed under Computer Society sponsorship are generally well received internationally. This is no doubt in some part due to the amount of international participation withi many of the Computer Society's standards working groups. Recently, the Computer Society has been encouraged to submit mor of its standards for international consideration. For example, the ISO standards committee concerned with software engineering passed a resolution directing its secretariat (Canada) to approach the Computer Society directly on this matter.

FEDERAL ROLE IN INTERNATIONAL STANDARDS

Limited federal participation in international standards activities hinders the effective representation of all U.S. interests in that process. For example, over the years the federal government has played a substantial role in the development of U.S. information technology standards — often as the only participant representing the interests of users. When these U.S. developed standards were adopted internationally, U.S interests were well served.

Today, many information technology standards are first develope within the international standardization process and then adopte by national standards bodies. This approach, when successful, tends to preclude the development of dissimilar national standards which impede free trade. However, the higher costs of international travel, coupled with declining budgets have made i extremely difficult for the federal government to provide neede support for high priority standard activities within the United States, much less internationally. As a result, the interests of U.S. government and industry users are increasingly absent from key discussions. Further, U.S. delegations comprised mostly of vendors are usually regarded with suspicion by foreign delegates — a reaction which adds further complications to an already difficult negotiation process.

ROLE OF ANSI IN INTERNATIONAL STANDARDS

ANSI serves an important role with respect to U.S. interests in international standardization. As the member body representing the U.S. in both the ISO and IEC, it administers U.S. participation in ISO and IEC activities. Operationally, this requires the rapid and orderly distribution of massive amounts of paper documents, monitoring of extensive schedules of due dates, appointment of U.S. delegates to meetings, and the timely processing and forwarding of U.S. position papers, votes, and technical contributions to the appropriate body. To effectively carry out these duties requires knowledgeable, dedicated staff and ever-increasing financial resources. Funding shortfalls have been a factor that has hindered ANSI's effectiveness in meeting its obligations.

Recently, ANSI has made a number of improvements in its support of U.S. interests in the growing area of international information technology standards. A new oversight committee has been formed and funding is being solicited from organizations interested in this area of standardization. While the results have been encouraging, the need still exists for increased federal participation in all levels of the international standards process.

RECOMMENDATIONS

For U.S. interests to be effectively represented in international standardization activities, at least two criteria must be met: (1) the interests of BOTH vendors and users must be represented and (2) adequate resources must be provided for administrative and technical support. An expanded federal role in international standardization should be defined, accompanied by increased funds to fulfill that role.

The mission of the National Institute of Standards and Technology (NIST) is well suited to providing federal leadership at the higher levels of U.S. participation in international standards activities. However, an expanded federal role should complement and not replace the valuable role performed by ANSI.

NIST and possibly other federal agencies would require additional funding to increase federal participation in high priority, international standards activities. For over two years, the IEEE has called for steps to increase the overall budget of the National Institute for Standards and Technology (NIST). This past April, speaking before the House Appropriations Committee Subcommittee on Commerce, Justice and State, the Judiciary and Related Agencies, the IEEE again stated that there can be little doubt why the international competitive position of the United

States continues to decline when the federal government does not adequately support its own standards role. Effective federal participation in international standards activities will not only enable the government to develop standards needed for its own cost-effective operation, but as pointed out earlier will improve the overall effectiveness of U.S. participation in international standardization.

We are pleased to have been able to share our views on this important subject and would be happy to assist in any other way that we can.

HELEN M. WOOD

Educational Background:

B. S. (Mathematics), University of Maryland
M. S. (Computer Science), American University

Experience:

In August 1988 Ms. Wood accepted an appointment as Director of the Office of Satellite Data Processing and Distribution in the National Oceanic and Atmospheric Administration (NOAA). She directs three divisions responsible for a space and Earth-based system encompassing the world's largest flow of real-time environmental data gathered by NOAA's weather satellites.

Prior to her current appointment, Ms. Wood was Deputy Director of the Institute for Computer Sciences and Technology, National Bureau of Standards (NBS) (now the National Institute of Standards and Technology). In this position she directed NBS activities in computer and communications standards, technical assistance to other government agencies, and computer science research. In previous positions at NBS, she directed the Center for Programming Science and Technology, Center for Computer Systems Engineering, and Information Systems Engineering Division. She performed research in computer networking, computer security, and process control and has a number of publications.

Professional Activities:

Chair, Federal Interagency Committee on Information Resources Management (1989-90). Member of the National Academy of Public Administration Panel on Electronic Record Keeping (1988).

1989 President-Elect of the Computer Society of the Institute of Electrical and Electronic Engineers (IEEE), First Vice President (1988), Board of Governors (1986-87), Vice President for Standards (1986-88), Treasurer (1984-85). Member, IEEE Standards Board (1986-88). Associate Editor for Standards, IEEE Computer Magazine (1986- 1989).

Senior Member of IEEE, Member of IEEE Computer Society, IEEE Oceanic Engineering Society, IEEE Geoscience and Remote Sensing Society.

Recipient of Department of Commerce Silver and Bronze Medals, Member of Senior Executive Service.

Mr. **Walgren**. Thank you very much, Ms. Wood.

In the computer industry in particular, how does the advent of Europe, and perhaps not just its advent because I was under the impression that, with respect to computers, there have been different standards in Europe that then were not able to be compatible with United States equipment when sold into the Third World or the like. How have—have we been hindered by the differences in product in computers between those made in Europe and sold in Africa and elsewhere and our own products?

Ms. **Wood**. Well, a difficult question, Mr. Chairman. The fact is, of course, that the United States was the leader in exporting hardware technology, an area, especially in the semiconductor chip area, that we have seen diminish over time. Software technology has been the—some say the last of the areas in which the U.S. has had dominance internationally. That, too, is diminishing.

The standards issues, indeed, early on in information technology standards, the standards of individual countries, could provide a bit of a barrier, but the Europeans especially and now the Japanese have been very aggressive in encouraging and funding the development of international standards, because they too were faced with problems. They had an uphill struggle to catch up with us and needed to aggregate their clout, if you will, to be able to be effective. This drew the United States into international standards development, which was initially for defensive purposes. It does provide some opportunities for us now.

I would add that behind the standards, I believe in earlier testimony, it was mentioned that the area of conformance testing or certification is a factor to be considered, and in this area, even though we see that international standards are being developed and developed very aggressively with or without full U.S. participation, even if we don't have a problem with the initial technical specification, if the tests that are used to approve products to determine that they support the standard are not open, if they have any biases within them, then we have—you know, it's as if we have no standard at all.

Mr. **Walgren**. Is there talk of standardized tests and standardized certification processes?

Ms. **Wood**. This is something that we have—we have not been—we, in the U.S., overall, have not been very supportive of, except within the Federal Government in the past. Within Europe, the CEN/CENELEC, as Mr. Peralta mentioned, is very active in promoting harmonized tests for Europe, and in the U.S., in the information technology area, the National Institute of Standards and Technology has had a program since the seventies for Government purposes to standardize tests, if you will, and in recent years there has been dialogue between NIST and international organizations who are trying to, wherever possible, promote one set of tests. This is an uphill struggle. It will take much additional work.

Mr. **Walgren**. Mr. Brown.

Mr. **Brown**. I'm afraid that much of the detail of what all three of you have presented probably goes beyond the scope of comprehension of most of us, but there are some essential elements that I think we need to get to.

First, am I correct in understanding that the U.S. is one of the very few countries that relies exclusively on private voluntary testing activities to establish national standards, and particularly to be represented in international standards organizations like ISO?

Mr. **Peralta.** I believe that there are a number of countries that have their activities based principally on a voluntary, private sector system.[3] Certainly the U.S. is the one that is most significant in this arena.

The activities of DIN, of BSI, and some of the other European organizations are funded by Government, at least in part, and, for example, DIN is funded to the extent of something like about 19 percent of their budget. They are, in fact, though, viewed as private sector organizations, and their activities, and, in fact, the question of representation in ISO and IEC, I raised this question attending the first meeting just this past March, and, clearly, the view of both the general secretariat of ISO and IEC is representation—is private sector representation, it is not Government representation.

Mr. **Brown.** I don't think in this committee that you're going to find many critics of our system of private industry activity in this area. I think we would prefer that private industry continue to play the major role and that there be only such Government connection as would enhance the effectiveness, and that may include funding in some cases, of the system. We seem to be moving along that path in a number of technological areas. We seem to be emphasizing this, what we call, industry-led consortia approach to R&D in certain advanced technology areas and other steps of that sort, which is compatible, or we think it's compatible, with America's tradition and with effectiveness.

But I'm disturbed that there may be some gaps here. I'm concerned, Ms. Wood, by the problem that you raise that in international settings we may appear to be fronting for big business, for example, rather than the interests of a broader constituency, including the public, and I'm also concerned, from some of the earlier testimony, that we may not be aggressively pushing U.S. standards in markets such as the Third World. Are these correct concerns?

Ms. **Wood.** If I could speak to the issue of being perceived perhaps as fronting for big industry, the concern or the factor there that concerns us is when the industry representatives on a delegation or on a standards committee are only representing one aspect or segment of that industry, such as the builders of the technology, the systems, and perhaps not the users—in the case of hardware systems, the computer vendors as opposed to the General Motors or Boeing—and that is a problem.

Mr. **Brown.** All right. How about the other aspect that I mentioned—inadequate representation of U.S. interests in certain developing market areas, the Saudi Arabian thing that was brought up earlier, for example?

Mr. **O'Grady.** If I may make a brief comment; I'm sure my colleague here will have another one. ASTM, with its own funds, has already been to Saudi Arabia. We've given courses, training programs, on how to use ASTM's standards in Saudi Arabia. We've already done it in South America. We've done it all over the United States, to promote the use of ASTM standards in these marketplaces.

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[3] See Appendix.

However, it's the ASTM position that a great deal more still needs to be done and it can only be done with assistance from the Government. What ASTM does is, it puts a packet of information together once a year and sends it to every embassy in the world so that the embassy has the information. But that is far short, in my opinion, of what we need in order to make the presence of American technology a very real part of the developing countries' financial situation.

Mr. **Brown**. All right.

Before you respond, Mr. Peralta, can we make a slight distinction between ASTM and ANSI with regard to your interest in this thing? And I am not speaking as an expert, merely as a layman, but it seems to me that ASTM has an interest in the broader aspects of materials in general. The standards contribute to the safety of construction and so on. ANSI has a great interest in product standardization from the standpoint of marketing.

No? Okay. Go ahead with your comment then.

Mr. **Peralta**. If I can clarify that point, ASTM is a member of ANSI.

Mr. **Brown**. Yes.

Mr. **Peralta**. As are, as I said in my earlier comments, all of the significant major standards developing organizations in the United States. ASTM is a standards developer; ANSI is not a standards developer, ANSI is the umbrella organization charged with the responsibility of coordinating activities of ASTM, ASME, and IEEE, and all the like standards developing organizations in the United States for the purposes of being sure that the activities are being performed effectively with due process and in an open system.

I'd like to come back to reinforce one comment that you made in leading into your questions—that is, the question of the relationship between Government and the private sector—and I clearly feel—having been on both sides of Government and the private sector, I clearly feel in this day and age that there is a need for a closer relationship between Government and the private sector, and my comments refer to the MIT report which clearly identified Government and private sector working at cross purposes of being one of the major detractors from U.S. competitiveness internationally.

I think the issue of—you also raised a comment in terms of—and it's come up a couple of times—in terms of representation. One of the jobs that ANSI has is to ensure everybody with a material interest is represented in the process. The mechanisms that exist which are provided for the record provide for openness, provide for appeals, and provide for all material interests to be heard in the process.

The question of dominance on the part of multinationals is certainly something that we need to be sensitive to, and maybe the best way to try to put that in perspective is to characterize the membership of ANSI. The membership of ANSI—85 percent of the membership of ANSI are medium to small companies that pay

$5,000 or less to ANSI. The larger corporations are about 14 percent of ANSI's population. So I think it's important to note that.

I think it's also important to note that while the emphasis has been on the private sector role and the question of funding, let's not overlook a very key role that Government has that was brought out in some of the earlier comments in providing participants to the process. Government clearly is a benefactor of the standards, the voluntary standards activity, and the commitment of Government personnel and the funding of Government personnel continuing in the process, is very critical.

If I were to say what I would identify at this juncture as one of the most significant challenges for the u.s voluntary standards community, it's to continue to ensure that quality people participate in the process. Clearly, with the kinds of changes that have occurred in American industry, the question of losing the expertise and the people to retirement and to other activities is very important.

So it's essential that the United States make the general public, the private sector, aware of the importance of the commitment of the resources which, in fact, is probably the critical link, as opposed to the general question of funding of the voluntary standards activities.

Clearly, ANSI doesn't have a lot of free money, and, in fact, when I joined ANSI we were in a very difficult financial situation six months ago. Fortunately, through a number of efforts that we have embarked on, financially ANSI is doing well this year. We need to increase our activities as we look to 1990 and beyond, and certainly because of the issues of EC-92, but let's not forget, I've also visited Japan and the activities that we need to focus on relative to Japan.

In that regard, we are examining the funding base for ANSI. The funding base for ANSI involves perhaps half of the players that are currently involved in the national standards activities. That is, there are a number of organizations, companies, and Government being one of these, that really at this stage, in my personal view, are not paying their full way. They are benefiting from the system, participating in it, but are not supporting financially the overall aspects of the voluntary U.S. system. Therefore, I think—and this is certainly one of my agenda items—very critically, is to deal with the issue of free riders, and the ANSI board is very dedicated to deal with that issue.

I am fully convinced that if we can get the organizations that are currently participating in the system and not paying to pay, that the system will be healthy from a financial viewpoint and perhaps will not need to be looking to Government to provide supplemental funding for the activities.

I do think that there is a role for Government in various aspects, and I think that comes under the context of what I would define as a national partnership in my discussions earlier.

Mr. **Brown**. Well, we'd like to help define that national partnership better. It's a difficult question.

Let me just say one final thing in the form of a question. A few years back, I had some peripheral contacts with an effort to achieve standardization on something as prosaic, I think, as a computer keyboard, and my recollection is that that process went on for years without much satisfactory results, and in part it was attributed, I think, to the fact that one of the players, one that you might describe as an 800-pound gorilla, really wasn't too much interested in standardization. That situation isn't true today, is it, that one particular firm might desire not to have standardization in order to maintain a market share that they felt would be better achieved by nonstandardization?

Mr. **Peralta**. I think it's fair to say that standards are of strategic significance to business, and therefore, in many respects, their activities are reflected in what they do in connection with the system.

It's our job, ANSI's job and the job of the standards developing organizations, to be sure that no single corporation or organization be an 800-pound or gorilla, or whatever, dominates the system, and, in fact, this was one of the issues that I faced very early in joining ANSI, I think we dealt with it very, very effectively, and I would say—you're talking about the computer information technology arena—I think the United States enjoys, building on John Woods' comments, the strongest commitment, and effective commitment, to the international standards arena and the information technology, and, frankly, we have a very, very significant position in that.

In fact, the plenary meeting for what is commonly referred to as JTC-1 was held in Paris recently, and of the 106 resolutions that came forward for decision in that forum, the U.S. position prevailed in 105. So we have a very, very strong role, leadership position, which we are maintaining in that arena, and, as I said earlier, it's not only in the information technology arena, it is in other aspects of what are considered to be the most economically significant sectorial parts of the international standards activities—petroleum products, banking, and others.

Ms. **Wood**. Mr. Chairman, if I may speak to the issue of gorillas.

Mr. **Walgren**. Yes, and briefly, because we have to suspend to respond to the Floor vote. Yes, Ma'am.

Ms. **Wood**. I just wish to note that, with all due respect, the issue of control plays a—for strategic purposes, plays a major role within the United States standards organizations as well as internationally, and the fact that we support a grass roots approach to standardization and forming standards developing committees within the IEEE and the Computer Society we believe is a major factor behind our significant growth of the last 10 years.

Mr. **Brown**. Well, I think you would find great support from members of this committee in what you are doing in the IEEE and in the Computer Society. Our effort here has to be to represent some overall concept of the best interests of the consumer, who also happen to be voters.

Mr. **Walgren**. Let's us suspend briefly, and we will resume in 10 minutes.

[Recess.]

Mr. **Walgren**. Let me call us back to order, if folks could reassemble, and we'd like to recognize the gentlewoman from Rhode Island, Ms. Schneider.

Ms. **Schneider**. Thank you, Mr. Chairman.

I'd like to apologize to the panel that I was not able to join you earlier during some of the testimony. Regrettably, I was involved in another very timely hearing, so it's not to indicate my lack of interest in this topic. I am very interested, and as the cofounder and cochair of the Competitiveness Caucus here in Congress, we find this particular challenge one that we feel we should be mobilizing Members of Congress to focus some attention on.

My question, however, may have been answered earlier, but I would certainly appreciate it if it could be restated, if necessary, and that is, in my effort to find a solution to the challenge that we face, is it the opinion of this panel that perhaps the best approach is one whereby we enlist the services of the Department of Commerce more specifically, and, if that is so, let me ask what would be the possibility of having the responsibility of being our envoy to various regions of the world or various countries for the setting of standards to come from the State Department and be our economic attache in each of these embassies in a variety of countries? Could not this role be filled by our economic attache in foreign pots?

Ms. **Wood**. Well, it's a possibility.

Certainly in our experience that has not been an avenue that has been exploited, and I guess a general observation here from the IEEE Computer Society would be to look for complementary and supplementary roles along these lines, increasing the role of the Department of Commerce and, most specifically, the National Institute of Standards and Technology, teaming with other agencies, where appropriate—this may be one such instance—but not losing the—not attempting to duplicate or immediately—or attempting to abruptly replace ongoing work that is being managed out of the American National Standards Institute. So creative coalitions, if you will, would seem prudent and subject to regular review and evaluation.

Mr. **Peralta**. I would offer some comments, if I may, as well.

Ms. **Schneider**. Yes.

Mr. **Peralta**. I think the economic attaches associated with all of the embassies, I think would be an excellent vehicle for representing U.S. interests.

I think one of the issues, though, at this point in time, which is a private sector issue as well as a governmental issue, is, the full awareness of the significance of standards has not yet filtered through the system. That applies to the private sector as well as the Government, and I really think, within the context of a national partnership, the Commerce Department and ANSI ought to join together in raising the level of awareness of both Government and private sector on the issues of standards, and I think that would be a very, very positive step forward, and it goes back to what I was saying earlier on the funding issue, because some of the aspects of the funding shortfall or the funding limitations result from the fact that[4] the information, the communications, the awareness has not been fully carried forward because events have developed very, very quickly.

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[4] See Appendix.

Ms. Schneider. This is part of my frustration not only on this issue but numerous other issues. It seems that where our problem really is, is in the failure to transfer information rapidly enough, it's an information transfer difficulty, and I think that as soon as people are well enough informed then we can put together the new coalitions or the new paradigms that are necessary to carry the agenda ahead.

So how do we get that information to move speedily enough, particularly when we have 1992 looming on the horizon and when we are seeing the Japanese move rapidly into the auto market in India and also into the energy market in Brazil and other areas. I certainly feel the urgency, but I'm not sure that I've gotten the technical fix here, the answer, as to how best to do it.

Mr. Peralta. Let me say that while standards are important, I don't think anybody should be misled to, this is the answer to U.S. competitiveness, because if you want to make any objective data comparison between U.S. standards activities and Japanese, U.S. dominates mightily. In fact, in terms of activities within ISO, we hold seven times the secretariats that Japan does.

So there are other issues that are involved in U.S. competitiveness than just standards, but I want to say that standards are important and we should not lose sight of that, but it's not the answer, it's not the golden bullet.

Ms. Schneider. But is it not beyond the standards? It's the individuals on the ground in those foreign countries who have familiarity with the standards that are essentially pushing the agenda of other foreign countries.

For example, it's my understanding—I think that it may have been mentioned or something—that the Japanese have six different representatives in Saudi Arabia pushing forward their standards and information relating to the kind of standards that they are generating. How many representatives does the United States have in Saudi Arabia trying to do the same thing or in, you know, China, or in other countries? So that it's just not the standards, as you say, but it's the people on the ground doing that sort of thing.

Mr. Peralta. I think the issue ought to be advocating U.S. imports, and standards are just one factor in the advocation of U.S. imports, and that ought to be the broader issue that ought to be dealt with and not just the one aspect, as I said earlier. I think that would be misleading to think—although I think standards are important, I'm involved in it, I don't think it is the single answer.

Ms. Schneider. All right.

Mr. O'Grady, did you want to add something?

Mr. O'Grady. Yes. I'd just like to say that, in response to your question, ASTM would support a greater role for NIST in cooperation with the Department of State in projecting American technology, whatever that means, into those countries. That's what the others are doing, and that's what the others are doing very well, and I would encourage this committee to consider the possibility of giving NIST a greater role in getting that sort of information out into the field.

Ms. Schneider. Okay. Thank you very much.

Thank you, Mr. Chairman.

Mr. Walgren. Thank you very much, Ms. Schneider.

Well, on behalf of the committee we want to thank you all for being a resource to us and participating in this process and look forward to talking to you about it in the future.

Let's then call and go back to Mr. Kammer, Ray Kammer, the acting director of the National Institute of Standards and Technology, accompanied by Dr. Stanley Warshaw.

If you folks would come up. And I think the ground rules at this point—we're having to accommodate some commitments through the noon hour, and I think I can project that we will not be able to reach the last panel until 1 o'clock, and for those of you on that panel, I apologize, but perhaps you could use the time to your best disposal. But we will be able to reach you at 1 o'clock, and at that point I think we could project the hearing concluding at 1:30. But, in the meantime, we have a limited time also, and I think I have to set a 15-minute time, and then we'll recess for half an hour between 12:30 and 1 o'clock, and I apologize for the inconvenience to the witnesses.

But welcome to the committee, our friend Mr. Kammer, whom we see so often and enjoy having whenever he comes. Your statement will be made part of the record, and we'd appreciate your focusing and summarizing to make your points as powerfully as you can.

STATEMENT OF RAYMOND KAMMER, ACTING DIRECTOR, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, GAITHERSBURG, MARYLAND, ACCOMPANIED BY STANLEY WARSHAW, ASSOCIATE DIRECTOR FOR INDUSTRY AND STANDARDS

Mr. **Kammer**. Thank you, sir.

In the interests of the very short time we have, I will simply address what we regard as the issues, what we think the United States may wish to consider doing.

It's our point of view in the Department of Commerce that the U.S. has to become much more aggressively involved in ISO, IEC, and in the other international standards development activities if we're going to maintain or increase our penetration of foreign markets.

Secretary Mosbacher has already succeeded in getting European regional standards organizations, CEN and CENELEC, to increase their effort to adopt international standards. U.S. manufacturers that wish to export need international standards in order to profit from the economy of producing a single product for both domestic and foreign markets.

We believe the United States has to improve its participation in International Standards Committee activities. We want to—we would recommend getting more secretariats of more technical committees, subcommittees, and working groups, and we also believe we should promote the initiation of new international standards, especially for those products and processes where the U.S. has the edge in technology.

Moreover, we think it would be wise to seek to modify the voting procedures of ISO and IEC to reduce the current disadvantage where the U.S. has one vote on standards matters and the European Community members have 12 votes or sometimes, when the European Free Trade Association countries vote with them, 17 votes.

Secretary Mosbacher has asserted to the European Community that increased reliance should be placed on international standards. We have also encouraged the greater use of international standards by the signatories of the GATT Standards Code as a method for reducing nontariff barriers to trade, and, of course, we think that it would be wise to promote the use of international standards in lesser developed countries.

Basically, in summary, our feeling is that a much stronger U.S. involvement in international standardization is cost effective and would be valuable to the U.S. economy.

Thank you, sir.

[The prepared statement of Mr. Kammer follows:]

NIST

UNITED STATES
DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS
AND TECHNOLOGY

STATEMENT OF RAYMOND G. KAMMER, ACTING DIRECTOR
BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
JULY 25, 1989

Mr. Chairman, Mr. Boehlert and Members of the Subcommittee:

I am Ray Kammer, Acting Director of the National Institute of Standards and Technology. I am very pleased to have the opportunity to speak on behalf of the Department of Commerce on the Federal Role in International Stanardization

BACKGROUND

Documentary standards are critical instruments of both domestic and international trade. They are the written descriptions of products or servic upon which buyers and sellers agree to transact business. They are used by individuals, companies and government agencies to procure goods and services, and also serve as a basis for establishing mandatory requirements to ensure fo the safety and health of our people and to protect the environment.

In the United States there are some 39,000 voluntary engineering standards, these are documents developed by committees of more than 400 diverse and independent private sector organizations. These organizations include trade associations, such as the American Petroleum Institute, the Electronics Industries Association and the Society of the Plastics Industries; professional societies, such as the American Society of Mechanical Engineers, the Institute of Electrical and Electronics Engineers, and the Society of Automotive Engineers; standards development organizations, such as the American Society for Testing and Materials, the Corporation for Open Systems, and the American Lumber Standards Committee; and certifying organizations, such as Underwriters Laboratories.

The standards produced by these organizations are characterized as "voluntary standards" because they are initiated and developed voluntarily. However, many such standards take on a mandatory role when they are incorporated in purchase specifications, referenced in state or Federal laws, or become widely accepted as marketplace requirements.

These 39,000 voluntary standards of the private sector are supplemented by another 50,000 Federal government standards and specifications set by the Department of Defense, the General Services Administration and other Federal agencies for the procurement of goods and services. Thus, in total, the United States has approximately 89,000 domestic standards produced by a multiplicity of organizations of various types. A Federal standards policy, established in

OMB Circular A-119, encourages Federal agencies to utilize voluntary standards in their procurement and regulatory programs, to the maximum extent feasible.

The U.S. voluntary standards community is pluralistic in nature with the American National Standards Institute (ANSI) functioning as a coordinator of domestic standards activities. The U.S. standards community is schematically depicted in the attached chart. ANSI's members include government agencies, companies, trade associations, professional societies and standards development organizations. ANSI standards represent about one-fourth of the total U.S. inventory of non-government standards. ANSI members produce an added 20,000 standards that are not processed through ANSI. The government agency contribution exceeds that of the private sector for a total of 89,000 U.S. standards.

ANSI also functions as the member body of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). ISO is generally responsible for the development and publication of international standards for non-electrical products and IEC is responsible for the development and publication of international standards for electrical and electronic products.

INTERNATIONAL STANDARDS

International standards are rapidly becoming more important than domestic or national standards. International trade is growing faster today than the sum of the gross domestic national products of the industrialized countries in the world. International harmonization of standards can lessen the pressures for protectionism and arbitrariness in trade. Most all industrialized countries have a strong governmental involvement in their national standards system in order to insure their representation in international standards through an effective national standards program.

FOREIGN STANDARDS PROGRAMS

I would like to take a moment to briefly describe the national standards system of several of our major trading partners.

United Kingdom

In the United Kingdom, the British Standards Institution (BSI) coordinates the development of standards and the testing and certification of products for conformance to standards. BSI represents the U.K. in ISO, IEC and other international standards development activities, and conducts a major information program (called Technical Help to Exporters) to assist U.K. firms in exporting their products all over the world. The British government provides about one-fifth income of BSI's income.

Federal Republic of Germany

Deutsches Institut fur Normung (DIN) serves as the standards organization for the Federal Republic of Germany (FRG) and as the official representative to non-treaty international standards organizations, such as ISO and IEC. The government provides 19% of the funds necessary to support the DIN operations.

Japan

The Japanese Ministry of International Trade and Industry (MITI) is responsible for the Japanese Industrial Standards (JIS) program and authorizes the Japanese Standards Association (JSA) to develop, with industry, the standards that are to be implemented by the government. The government provides 100% of the costs of their standards program.

France

The French standards organization, Association Francaise de Normalisation, (AFNOR) is the only organization authorized to publish national standards, including those used for government procurement. AFNOR provides official representatives to non-treaty international standards organizations and to regional standards organizations, such as CEN (the European Committee for Standardization) and CENELEC (the European Committee for Electrotechnical Standardization). The French government provides about one-third of AFNOR's income. AFNOR is extremely active in international standards work, holding 18% of the technical Secretariats in ISO, more than the U.K., Germany or the U.S.

Canada

In Canada in the 1960's, a number of different organizations were developing standards and several organizations were testing and certifying products - all in an apparently uncoordinated and independent manner. A Canadian government study of their standards problems was initiated in the late 1960's after the primary standards-writing organization - the Canadian Standards Association (CSA) - requested increased funding to underwrite its increasing costs of participating in international standards activities. At the time, the Canadian government was providing funds to cover the membership dues to ISO and IEC, but CSA wanted additional funding to subsidize administrative, as well as travel costs associated with Canadian representation in international standardization activities. The Parliament-created standards study group developed a series of recommendations that led to the establishment of the Standards Council of Canada (SCC) in 1970.

The mission of the Standards Council of Canada, as described by the Canadian Parliament, is five fold:

1) to accredit standards development organizations (five have been accredited to date);

2) to assign specific subject areas to standards development organizations to avoid duplication of effort;

3) to promote the establishment of Canadian National Standards;

4) to accredit product certification and testing programs; and

5) to increase Canadian participation in international standardization programs.

The SCC has significantly increased Canadian participation in international standardization activities. They have done this by subsidizing transportation expenses for Canadian representatives and by designating Canadian standards experts as official Canadian government representatives to international standards committees.

Adoption of International Standards

ISO and IEC standards comprise 43% of the Danish national standards, 37% of the French national standards, 22% of the Dutch standards, and 16% of the British standards. These high percentages are facilitating harmonization of European requirements in the development of the EC-1992 Single Internal Market. Less than a half of one percent of ISO and IEC standards have been formally adopted as American National Standards.

ISSUES

Where does all of this leave the United States? We in the Department of Commerce believe that the U.S. has to become more aggressively involved in ISO, IEC, and other international standards development activities if we are to maintain or increase our penetration of foreign markets. Secretary Mosbacher has already succeeded in getting the European regional standards organizations, CEN and CENELEC, to increase their efforts to adopt international standards. U.S. manufacturers that wish to export need international standards in order to profit from the economy of producing a single product for both domestic and foreign markets.

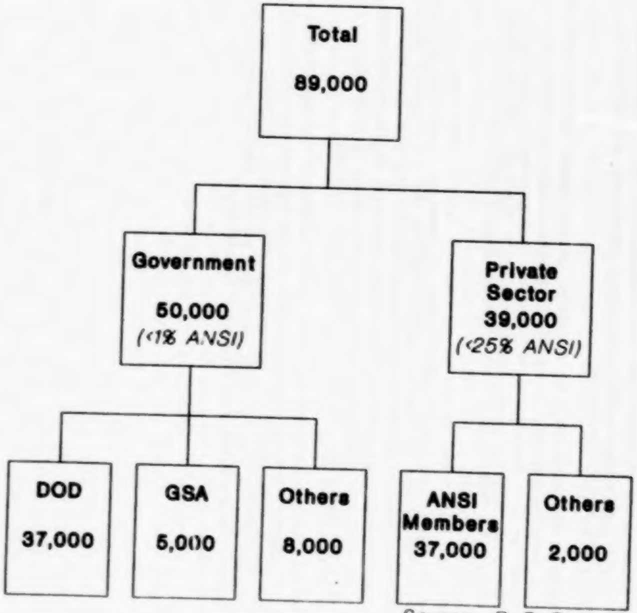
We believe that the United States must improve its participation in international standards committee activities. The U.S. should aggressively seek and obtain the secretariats of more technical committees, subcommittees, and working groups. We must promote the initiation of new international standards, particularly for those products and processes where the U.S. has the edge on the technology.

The United States must seek to modify the voting procedures of ISO and IEC to reduce our current disadvantage of one vote on standards matters, where the European Community members have 12 votes, or 17 when the CEN/CENELEC members of the European Free Trade Association (EFTA) countries vote with them.

Secretary Mosbacher has asserted to the European Community that increased reliance should be placed on international standards. We have encouraged greater use of international standards by the signatories to the GATT Standards Code as a method of effectively reducing non-tariff barriers to trade. We should encourage developing countries and newly industrialized countries to adopt international standards, in order to facilitate trade and reduce their standards development costs.

A strong U.S. involvement in international standardization is critical to the production and marketing of cost effective, high quality U.S. products for other national markets.

U.S. Standards


Total
89,000
Government
50,000
(<1% ANSI)
Private Sector
39,000
(<25% ANSI)
DOD
37,000
GSA
5,000
Others
8,000
ANSI Members
37,000
Others
2,000

Source: R. B. Toth, Associates (1989)

RAYMOND G. KAMMER

Acting Director
National Institute of Standards and Technology (NIST)
(Formerly National Bureau of Standards (NBS)
United States Department of Commerce

Ray Kammer is Deputy Director of NIST. He is currently Acting Director as well. NIST is the Nation's central laboratory for measurement and standards research in support of U.S. industrial needs. Kammer manages the NIST staff of close to 3100 physicists, chemists, mathematicians, engineers, and support personnel.

A graduate of the University of Maryland, Kammer joined NIST in 1969 as a technical program analyst. Over the following decade he served the agency and the U.S. Department of Commerce in a succession of offices concerned with budgetary and program analysis; planning; and personnel management. In 1980, Kammer was appointed Deputy Director of NIST.

In addition, Kammer has served as chairman of several important evaluation committees for the Department of Commerce, including reviews of satellite systems for weather monitoring and the U.S. LANDSAT program, and the next generation of weather radars used by the U.S. government. He is now serving a three-year term on the Board of Directors of ASTM, a major international organization for the development of voluntary standards for materials, products, systems and services.

His awards include both the Gold and Silver medals of the Department of Commerce, given for meritorious service to the Department and the nation, the William A. Jump Award for Exceptional Achievement in Public Administration, the Federal Government Meritorious Executive Award, and the Roger W. Jones Award for Executive Leadership.

February 1989

Mr. WALGREN. Well, thank you very much, and your written statement will be made a part of the record.

What can you tell us about the dialogue between Secretary Mosbacher and the European Community officials with respect to U.S. access to European Community standardization? Is there anything more that can be said about that? We're pushing for international standards, but I understand we're really trying to get specific ongoing access as well.

Mr. KAMMER. One of the aspects of this would be a permanent presence at the EC in Brussels, and one of the proposals that Secretary Mosbacher has made to Secretary Baker is that three Department of Commerce employees, one an expert in standards from NIST, become permanent members of the U.S. delegation in Brussels, and that would be a start.

Dr. Warshaw has been spending a good third of his time on these issues over the recent past. I'd like for him to comment. I think he can tell you more.

Mr. WARSHAW. Yes, Mr. Chairman. The Secretary has taken a very active interest in the standardization issues related to the EC, and by standardization I'm including the methods of conformance to standards, certification and testing in particular. In fact, on July 5 the European Community finally approved a new directive dealing with the issues of certification and testing and how they are going to measure conformance to the standards for products. This is going to be very important in trade, and we are actually having hearings in the Department of Commerce tomorrow and Thursday, getting the input from the standards community, the testing community, and industry in general on these issues. We are putting together a framework and a delegation to go with the Secretary either in late September or early October to the EC to further discuss the matters of certification and testing, as the Secretary already did in late May with respect to standards, and we were effective in working out an agreement with the EC as to the openness of their endeavors and the fact that they would encourage the adoption of international standards and the like, and this has appeared in the press. The agreement has appeared in the press, and, in fact, many other countries, as a consequence of this, have actually approached the EC seeking similar sorts of agreements.

So I think the Secretary has taken the leadership in this area, and his aggressive action has already resulted in such an agreement, consideration of CEN and CENELEC, the regional organizations, to adopt international standards, in our further endeavor to pursue this fall the matters of certification and testing, which they intend to implement at the end of 1992.

Mr. WALGREN. Well, I guess the concern is that we will get distracted by something else and we won't be players there. In the early stages when we ought to be players, our track record is one of having difficulty coming up with the resources to do even things that everybody wanted to do, and with respect to Mr. Dymally's interest about representation in developing countries, everyone agreed that we ought to have some presence there, but no one had the money to do it, and the money wasn't much—it was $200,000 or something like that—and yet it could not be found in the Commerce Department's budget, and I guess I could only hope that this idea of going to Brussels has budget support as well and can be done.

Canada, as we heard today, has a standing office and standing representation in Brussels, and we do not. You really wonder whether we are doing the right thing when that is the case.

What about this role of the U.S. in promoting our presence in standards decisions made by developing countries? These countries look to the United States economy, and yet they've got a salesman from Japan stationed right at their left elbow, asking them and suggesting that they go forward in a way that then would tend to exclude our goods. What is the defense to that?

Mr. **Kammer**. Well, I don't think that—it works to our—it definitely works to our disadvantage to have other people aggressively pushing a certain style of doing things, which is basically what a standard, a product standard, is, that is compatible with the domestic usage of the advocate and incompatible with our usage in terms of products.

The nature of the structure of standards development in the United States has taken a pretty different course from what has happened in most other countries, and I think what happens a lot of times is that private companies are very willing to promote something very specific to their product but not too eager to promote a generic standard, if you will, that might describe the products of four or five domestic competitors, U.S. competitors.

Mr. **Walgren**. Is it time to move beyond that and develop some kind of partnership, as ANSI has suggested, that Canada obviously did 10 years ago, 20 years ago? Would the thought that the private sector interest, particularly in a country preoccupied with its domestic market, as ours is, just doesn't have the motivation, the direct motivation, to incur expenses to be present in distant parts of the world on an ongoing basis way in advance of the actual payoff of the commercial practices?

Mr. **Kammer**. I think that as we get closer to a world economy, if we aren't already there, the people that don't do that are going to clearly be losers, especially as EC-92—maybe it doesn't happen in 1992, but when it does happen in the nineties, that will tend to provide a very single, coherent voice on standards issues that will dominate the world standards decisions in the absence of representation from the United States, in my opinion, and I think the time is fast coming upon us when we need to make some decisions on this.

Mr. **Walgren**. Certainly with the presence of the United States. If a good arrangement can be worked out between Europe and the United States, then that mass would clearly be the presence in the developing world. So whatever our relationship to Europe is, is really the critical juncture in the immediate future, in your view?

Mr. **Kammer**. That's my view, yes.

Mr. **Walgren**. But there seem to be things to be gained almost regardless of that. It's said that the Canadian effort in standards, even though its budget is similar to NIST—now NIST's budget is very small compared to ANSI and the private sector investment, I gather, and yet they are generating more requests for information on standards than the information is that the National Center for Standards and Certification Information generates. Is there a reason for that? They seem to be more in pursuit of that aspect of economic—

Mr. **Kammer**. As I recall, the number of requests per year in Canada is about 8,000, and the comparable number for the United States would be, I guess, about 4,600, 4,000 to our center and another 600 to the agricultural interests in the Department of Agriculture.

I think it's part of what you were talking about earlier. The focus of most domestic business in the United States on the domestic marketplace is pretty strong; 6 percent, I guess, of the U.S. GNP is associated with exports, which is comparatively small for a country—an industrialized country, and I believe that that will have to change, I think it inevitably changes, as the marketplace becomes sort of a world market rather than particular domestic markets.

That's one of the reasons we have been focusing so much on the idea of international standards rather than unique domestic standards that tend to serve as, if not a tariff barrier, a nontariff trade barrier, still as a disincentive for people to export if they have to cope with several different standards, one for a domestic market, another in some targeted country; it's more expensive for them and more difficult.

Mr. **Walgren**. Well, the time is getting away from us, but I think I ought to ask that you give us a submission about the increased effort that is being made with respect to the European Community, and certainly any that NIST has contact with, and, given the fact that all the organizations are now saying they want a greater participation of the Government, per se—at least that's what I hear; perhaps that's not quite—I guess I would like to know what the suggestion would be from the Administration about how the American effort internationally can be expanded with respect to standards; whether or not some Government funds should not be contributed to that; what kind of organization and independent structure would be advisable; and what kind of assurances to the private sector, as was done in Canada.

Certainly that seems to be the message now, that we're not doing enough, that our role is too limited, and the question I would have for the Administration is, given the fact that it's been very broadly said that our role is too limited, what can you recommend in the way of an increase in the Government role in that area?

Mr. **Kammer**. If I may make two comments, I believe that while most of the interested parties in the private standards writing organizations have an interest in some changes, I don't have the impression that they're at consensus yet.

You may remember back in the early seventies there were some discussions about some other approaches for standards than Government participation, and it had the effect of unifying all of the standards organizations in opposition to the discussion.

Mr. **Walgren**. Well, we'd appreciate receiving some summary of where you think this field is and where you would recommend that we go, and, with that, I have to suspend, and we will suspend until 1 o'clock, at which time we will resume.

[The material referred to follows:]

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
[formerly National Bureau of Standards]
Gaithersburg, Maryland 20899
OFFICE OF THE DIRECTOR

OCT 17 1989

Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research, and Technology
Committee on Science, Space and
Technology
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

Enclosed are our answers for the hearing record to questions you and Congressman George Brown posed at the Subcommittee's July 25 hearing on International Standardization: The Federal Role.

If you have any questions, please contact Esther Cassidy, National Institute of Standards and Technology Director of Congressional Affairs, at 975-3080.

Sincerely,

Raymond G. Kammer
Acting Director

Enclosure

cc: Honorable Sherwood L. Boehlert

Mr. Walgren

Question A: Would you give us a report on the DOC efforts to promote U.S. interests in EC 1992?

Answer:

The Department of Commerce is working to promote the awareness of U.S. business and industry to the trade implications of "EC-1992." We provide detailed technical information on EC standards and standards-related activities (including product testing, certification, laboratory accreditation and registration of manufacturer's quality assurance programs) to American business interests.

The Department has provided speakers on "EC-1992" at many meetings convened by trade associations and standards organizations as well as distributed information packages on EC-1992 to over 20,000 individuals and business organizations. It is estimated that more than 15,000 companies and business groups have been briefed by Commerce employees through these initiatives.

We have also developed a "EUROPE NOW" database, containing over 8,000 names and addresses, to distribute information through a quarterly newsletter to interested parties. The "EUROPE NOW" database includes the EC-1992 regulations and directives, analysis of EC initiatives by subject matter and selected industry sectors marketing information for European single market.

The DOC has also cosponsored programs with "multiplier" institutions such as the District Export Councils, State Trade Promotion Offices, and World Trade Clubs, as well as private sector organizations such as the "Big Eight" accounting firms and law firms specializing in foreign trade. It is estimated that over 4000 U.S. companies interested in exporting to Europe have been briefed on EC-1992, most of which were small or medium sized businesses.

We have developed a 100 plus list of standards and standards-related organizations as well as U.S. companies interested in EC-1992 and make regular mailings to transmit information related to developments in Europe involving standards, testing certification and laboratory accreditation. Over 3000 copies of an NIST report on the standards aspects of EC-1992 have been distributed during the last 11 months.

Secretary Mosbacher has taken a personal interest in "EC-1992" and has included it as one of the top priorities in the Department. He has taken the initiative to discuss the standards implications of EC-1992 not only with the appropriate officials in the EC, but also with the Presidents of CEN and CENELEC. These discussions have been fruitful in opening up the previously closed European standards development process and have resulted in increased transparency of their standards activities.

Mr. Walgren

Question 8: What would be the Administration's suggestion for an U.S. standards effort internationally, what level of funding, what sort of structure, interaction with the private sector, etc. to promote U.S. interests internationally, particularly in EC 1992?

Answer:

The Secretary of Commerce is already required legislatively to oversee and promote U.S. participation in international standards activities under Section 413 of the Trade Agreements Act of 1979, re. GATT. This legislation also provides the Secretary of Commerce with the authority to "make appropriate arrangements to provide for the adequate representation of United States interests" if the member organization to an international body does not demonstrate the requisite willingness and ability to adequately represent U.S. interests.

Consistent with the Secretary's responsibilities under the Trade Agreements Act, and because of the growing importance of international standardization to the U.S., the Department is actively seeking the recommendations of industrial and private sector interests on improving the effectiveness of the United States in international standardization. Based on these recommendations, we plan to conduct a hearing in the near future, at which time the Department will propose a model infrastructure, for discussion, for enhancing a governmental-private sector partnership to improve the use of U.S. technology and manufacturing practice through international standardization, certification and testing activities.

The Standards Council of Canada is a most intriguing example of an operation between government and the private sector since it maintains the independence of numerous standards development, product certification and testing organizations. The Department is exploring other examples of private sector/government relationships in standards setting.

The Department of Commerce favors a private sector standards community that is coordinated through a cooperative effort for aiding negotiations with the standards efforts of other nations or regions, such as the European Community (EC), on the transparency of standards, the mutual recognition of tests and reciprocal product certification arrangements.

International standards are of growing importance to the U.S. They are rapidly becoming the instruments used for specifying products in other national and regional markets. We must ensure that international standards reflect current U.S. technology lest we be "shut out" of markets. Protecting U.S. commercial interests and obtaining market openness for U.S. products are primary objectives of the DOC.

The pluralistic nature of the U.S. standards community is unique in the industrialized countries of the world. All other countries have a central standards organization that is chartered and partially, or totally, funded by its government. It is as yet unclear whether a more formalized private sector/government relationship would be appropriate for the U.S.

For your information, I am attaching two NIST publications of U.S. participation in international standardization activities in the past twelve months (NBSIR 88-3793-1 [8/88], and NISTIR 89-4124 [7/89]).

NBSIR 88-3793-1

A SUMMARY OF THE NEW EUROPEAN COMMUNITY APPROACH TO STANDARDS DEVELOPMENT

Patrick W. Cooke

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Office of the Associate Director for
Industry and Standards
Office of Standards Code and Information
Gaithersburg, MD 20899

August 1988

U.S. DEPARTMENT OF COMMERCE, C. William Verity, *Secretary*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

A Summary of the New European Community Approacn to Standards Development

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NOTE
This revision of NBS IR 88-3793-1 results from meetings in Brussels, Belgium, with EC officials and attendance at the EC "Symposium on Organizing Certification and Testing For Europe". Slight changes have been made in the Text to reflect more accurately the current EC policies.

A SUMMARY OF THE NEW EUROPEAN COMMUNITY APPROACH TO STANDARDS DEVELOPMENT

Abstract

This paper summarizes European Community (EC) plans to aggressively pursue its goal of achieving an "internal market" by 1992 and the standards-related implications of such a program on U.S. exporters. U.S. exporters will be affected by the implementation of EC directives, the harmonization of standards, and the strengthening of European regional standards bodies and other trade policy considerations affecting market access, including EC testing and certification programs. U.S. Government and EC contacts for obtaining additional information are provided.

1. Overview

- The European Community (EC)[1] plans to complete the "unification" of Western Europe through 1) further reductions of internal barriers to the freer flow of goods among Member nations, 2) regional currency considerations, and 3) a stronger European Parliament. The obvious aim is to improve marketing conditions for Members, both "at home" and abroad.

- The EFTA countries[2] are also involved. Cooperative arrangements with the EC -- including harmonization of technical regulations -- are underway to create a European Economic Space in parallel with completion of the EC's internal market.

- It is not yet clear how non-members will fare in the new single market, hence the time is ripe to look after U.S. interests. The U.S. Government's position has been, and is, to promote free trade - with the minimum number of restrictions.

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[1] The Member States of the European Community include Belgium, Denmark, France, Germany (F.R.), Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom.

[2] The Member States of the European Free Trade Association (EFTA) include Austria, Finland, Iceland, Norway, Sweden and Switzerland.

- Harmonization of standards is the easiest action to take, resulting in considerable progress to this point.

- Certification procedures and acceptance of test data may be more important issues but they have not yet developed. Attendant issues include the ability to enter the single market through multinational corporations or European subsidiaries of American manufacturers and mutual recognition of laboratory accreditation schemes.

2. New European Community (EC) Initiatives

The Commission of the European Communities (EC) is acting swiftly and deliberately to turn the twelve European countries into a single, integrated market of 320 million people by the end of 1992. The basis for this effort is a 1985 EC White Paper entitled "Completing the Internal Market."[3] That paper sets a timetable for the measures needed to ensure the free circulation of persons, products, services and capital among the twelve member states. The EC has already initiated a program to eliminate the many differing national standards and technical regulations; it has drawn up more than 200 EC directives aimed at harmonizing the various national requirements.

3. The Single European Act

The program being implemented by the EC has been further expedited by the Single European Act which was adopted in February 1986. It amends (for the first time) the 1957 Treaty of Rome, which serves as the EC's founding charter. The Act spells out the following major objectives:

- completion of the European[4] internal market by the end of 1992 to create a continental trade area;

- improved regional research and technological development;

- progress toward a European economic and monetary union; and

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[3] The paper is identified as COM (85) 310 final, "Completing the Internal Market" Commission of the European Communities, Brussels, June 14, 1985. This 93 page paper is available from the National Center for Standards and Certification Information (NCSCI) at the National Bureau of Standards (301 975-4040).

[4] Hereafter the term "European" is intended to be limited to the European Community (EC) and its member coutries unless otherwise indicated.

- improvement of the environment and working conditions in European countries.

In order to facilitate the EC decision-making processes, the Single Act provides for qualified majority voting (in place of the previous unanimity requirement) on issues related to completion of the internal market. This revised approval requirement strips individual EC countries of their earlier veto powers.

4. Standards-Related Measures--The "New Approach"

An approach initiated in 1979 resulted in a ruling that any product legally manufactured and marketed in one Member State must, in principle, be admitted to the markets of all the other members. On that basis, the EC is now developing policies intended to prevent new impediments to trade, based on the mutual recognition of test data and product certifications within the EC.

If it is necessary to establish a European Directive, it shall be limited to essential requirements for protection of health, safety, and the environment. The task of establishing European technical standards for products will be left to European standardization bodies set up by industry such as CEN,[5] CENELEC,[6] CEPT[7] and other European sectoral standardization bodies supported by European governments. In general, access to these European regional standardization bodies on behalf of U.S. interests has been either very limited, restricted to U.S. companies operating in Europe, or non-existent. In the absence of standards to be harmonized or cited, the CEN-type organizations are to develop standards based on international standards developed by such groups as the International

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[5] European Committee for Standardization (CEN) promotes European regional standardization in the non-electrotechnical field. CEN is the world's largest regional standards group. It is composed of European member bodies within the EC and EFTA countries.

[6] European Committee for Electrotechnical Standardization (CENELEC) promotes European standardization in the electrotechnical field.

[7] European Conference of Postal and Telecommunications Administrations (CEPT) publishes recommendations to harmonize and improve administration and operational services. CEPT has established a special body to prepare the necessary European standards for a unified telecommunications system. The new body is known as the European Telecommunications Standards Institute (ETSI). ETSI will have headquarters in Nice, France.

Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Failing that, individual Members may adopt appropriate National standards establishing health, safety, and environmental requirements.

The EC has recently made two significant changes regarding European standardization activities:

- o the existing European national standardization bodies have been restructured into a coherent group with a clear framework for mutual consultation and decision-making; and
- o work has been initiated on the expeditious development of a body of technical European standards that will be applied to "high technology" products and equipment sold within Member States (e.g., advanced composite materials and telecommunications equipment).

The EC and its Member States are now setting standardization priorities. In addition, the private standards organizations (CEN, CENELEC and CEPT) will, as a function of these priorities, generate European standards in consultation with the existing national standardization organizations. In some cases, new CEN Technical Committees have been established to facilitate the process (e.g., TC127 on Fire Safety). CEN, CENELEC and CEPT will be advised by a single technical committee consisting of both industry officials and users. (See Fig. 1 attached.) There are three significant changes from previous standards development procedures in the EC:

- o For the first time, a single, Government-body will set standardization priorities and require that all EC Member States adopt standards that conform to the essential features established by the directive.
- o A majority vote of EC Member States, rather than unanimity, will determine agreement on standards.
- o When an EC standard is agreed upon, conformity to it will then have legal weight in all Member States.

5. U.S. Standardization Concerns

The EC legislation dealing with standardization is likely to have a profound effect on U.S. exports since harmonization directives may be framed, albeit inadvertently, so as to exclude or hinder the entry of U.S. products into the European market. Of further significance will be the effect on U.S. imports from the EC since European products are likely to become less costly due to operational economies of scale and other economic benefits derived from standardization. At the present time, interested parties in the United States do not have the opportunity to review and comment on proposed EC standards and directives during the development phase, i.e., before they are published in final proposed form. This prevents the review and full consideration of U.S. inputs at a time when they might be persuasive.

6. EC Schedule for Industrial Standards
It has been reported that the EC intends, by the end of 1988, to complete the submission of all of its 39 White Paper proposals on industrial standards. They include the following "high priority" subject areas:

- gaseous emissions (motor vehicles and commercial vehicles);
- diesel particulates (passenger cars);
- food law (quick frozen foods, flavorings, extraction solvents, preservatives, infant formula, modified starches, food additives, materials and articles in contact with food, food labeling, etc.);
- pharmaceuticals and high technology medicines;
- chemical products (restrictions on the marketing and use of asbestos; classification, packaging and labelling of dangerous preparations; liquid fertilizers);
- construction and construction equipment;
- tower cranes (permissible sound levels);
- cosmetics;
- consumer protection regarding pricing of foodstuffs and non-food products;
- helicopter exhaust noise; and
- good laboratory practices for non-chemical tests.

The list of product categories covered by EC harmonization is constantly increasing. Parallel activities to regulate telecommunications in the EC are also underway. Although the White Paper identified the areas listed above as high priority areas, it does not preclude future standards work in other areas.

The EC is also working on directives for the mutual recognition of test data and certification in order to avoid wasteful duplication of effort in product approvals. This initiative will involve the drawing up of common conditions and codes of practice for implementation by testing laboratories and certification bodies. It will most probably lead to agreements for reciprocal recognition of national laboratory accreditation programs.

7. Further Information

o Additional information on the EC Internal Market program, the activities under the Single Act of 1992, and EC policies and programs that may impact U.S. commercial interests may be obtained by contacting the Office of European Community Affairs in the International Trade Administration (See Appendix B).

- Copies of the following documents may be obtained when available, from the NBS Office of Standards Code and Information (See also Appendix B):
  - Draft EC Directives (proposed rules)
  - Approved (final) EC Directives
  - European Regional Standards
    and
  - Standards-related documents published by CEN, CENELEC, CEPT and ETSI.

8. Conclusion

The EC is proceeding aggressively with plans to transform its 12 member countries into a single integrated market with harmonized standards and regulations by 1992.

The time for U.S. interests to react to the new policies and programs of the European Community is now. If we do nothing, it may become very difficult or expensive to market U.S. products in Europe in the future.

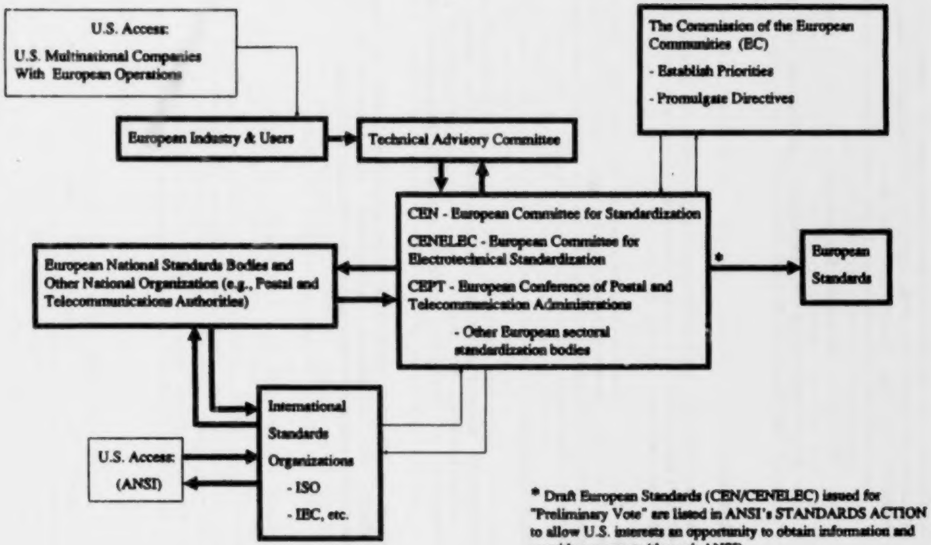
9. Recommendations

U.S. business intersts should establish communnications with their European subsidiaries, distributors, or their American industry associations to obtain up-to-date information regarding the development of European Directives and harmonized standards.

U.S. companies should seek and take opportunities to comment on, and attempt to influence, proposed European Directives and standards whenever such documents become available.

Figure 1

Diagram Depicting Interrelationships of Entities Influencing the Development of European Standards


U.S. Access:
U.S. Multinational Companies With European Operations
European Industry & Users
Technical Advisory Committee
The Commission of the European Communities (EC)
- Establish Priorities
- Promulgate Directives
CEN - European Committee for Standardization
CENELEC - European Committee for Electrotechnical Standardization
CEPT - European Conference of Postal and Telecommunication Administrations
- Other European sectoral standardization bodies
*
European Standards
European National Standards Bodies and Other National Organization (e.g., Postal and Telecommunications Authorities)
International Standards Organizations
- ISO
- IEC, etc.
U.S. Access:
(ANSI)

* Draft European Standards (CEN/CENELEC) issued for "Preliminary Vote" are listed in ANSI's STANDARDS ACTION to allow U.S. interests an opportunity to obtain information and provide comments (through ANSI).

(STANDARDS ACTION is published biweekly by the American National Standards Institute, 1430 Broadway, N.Y., N.Y., 10018.)

Appendix A
E.C. Contacts for Additional Information on European Standardization Matters

EC information offices in the United States are in Washington, D.C. and New York City -

European Community Information Service
2100 M Street, N.W., Suite 707
Washington, D.C. 20037
Tel: (202) 862-9500

European Community Information Service
305 East 47th Street
3 Dag Hammarskjold Plaza
New York, NY 10017
Tel: (212) 371-3804

In Europe, the principal point of contact is:
Commission of the European Communities
Directorate-General Information, Communication, Culture
Rue de La Loi 200
B-1049 Brussels, Belgium

CEN and CENELEC are headquartered in Brussels and have the same address -

European Committee for Standardization (CEN)
and/or
European Committee for Electrotechnical Standardization (CENELEC)
2 Rue Brederode
Bte. 5
B-1000 Brussels, Belgium
Tel: (011) (32) (2) 519-6811

CEPT (European Conference of Postal and Telecommunications Administrations) is headquartered in Paris -

Secretariat Permanent du Comite de coordination de l'harmonisation
CEPT/CCH/SP
9, rue Georges Ptiard (24 eme)
75015 Paris, France
Fax No. (011) (33) (1) 43 06 15 45
phone (011) (33) (1) 47 34 53 03

Appendix B
U.S. Government Contacts with Information on Various Aspects of EC Activities Related to Standardization

1. Office of European Community Affairs
International Trade Administration
Department of Commerce
Room H-3036
Washington, D.C. 20230
Tel: (202) 377-5276

2. Office of Standards Code and Information
National Bureau of Standards
Administration Building, Room A629
Gaithersburg, MD 20899
Tel: (301) 975-4040
Telex TRT 197674 NBS UT

3. Office of the U.S. Trade Representative
Technical Barriers to Trade
Room 513, Winder Building
600 17th Street, N.W.
Washington, D.C. 20006
Tel: (202) 395-3063

NBS-114A (REV. 2-80)

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5. AUTHOR(S)

Patrick W. Cooke

6. PERFORMING ORGANIZATION (If joint or other than NBS, see instructions)

NATIONAL BUREAU OF STANDARDS
U.S. DEPARTMENT OF COMMERCE
GAITHERSBURG, MD 20899

7. Contract/Grant No.

8. Type of Report & Period Covered

9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP)

10. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

This paper summarizes European Community (EC) plans to agressively pursue its goal of achieving an "internal market" by 1992 and the standards-related implications of such a program on U.S. exporters. U.S. exporters will be affected by the harmonization of standards, implementation of EC directives, strengthening of European regional standards bodies and other trade policy considerations affecting market access, including EC testing and certification programs. U.S. Government and EC contacts for obtaining additional information are provided.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

European Community; harmonization; international trade; regional standardization; single European Act; standards; U.S. exports.

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"AN UPDATE OF U.S. PARTICIPATION IN INTERNATIONAL STANDARDS ACTIVITIES"

Patrick W. Cooke

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards
and Technology
Office of the Associate Director for
Industry and Standards
Office of Standards Code and Information
Gaithersburg, MD 20899

Reference: NBSIR 88-3698 "A Review of
U.S. Participation in International
Standards Activities," January 1988

July 1989

U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary
Lee Mercer
Deputy Under Secretary for Technology
NATIONAL INSTITUTE OF STANDARDS
AND TECHNOLOGY
Raymond G. Kammer, Acting Director

An Update of U.S. Participation in International Standards Activities

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An Update of U.S. Participation in International Standards Activities

Abstract

This report presents updated information on the current level of U.S. participation in the two major international standardization bodies; ISO and IEC. Data on the new ISO/IEC Joint Technical Committee 1 (JTC 1) on Information Technology are also presented.

1. Introduction

1.1 Background

In early 1988, the Office of the Associate Director for Industry and Standards issued a report[1] as part of its responsibility for monitoring the adequacy of representation of U.S. interests in international standards activities.[2] That report described the role of international standards and their increasingly significant importance in world trade. It reviewed the levels of U.S. participation in the two major international standardization bodies - the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) - over the 20-year period 1966 - 1986. A coarse analysis of the data indicated some direct correlation between U.S. participation in international standards activities and U.S. exports for several product sectors, primarily those designated as high technology trade categories. This relationship seems to stem in part, from the general increase observed in world trade, plus the increasing multi-national and international aspects of U.S.-based corporations in particular. U.S. participation levels in the electrical and electronic fields, represented in IEC technical committees, have been greater than those in the non-electrotechnical disciplines covered by ISO.

This report lists changes that have occurred from 1986 through June 1989. Information was obtained from committee rosters published by the ISO and IEC and information provided by the

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[1] Cooke, Patrick W., "A Review of U.S. Participation in International Standardization Activities," NBSIR 88-3698; January 1988.

[2] NIST responsibilities detailed under Section 413, Title IV (on standards) of the U.S. Trade Agreements Act of 1979.

American National Standards Institute (ANSI)[3], the U.S. member of ISO. The United States National Committee of the International Electrotechnical Commission (USNC/IEC) is the U.S. member of IEC. Technically, the USNC is an independent organization; however, it is attached to ANSI through its Electrical and Electronics Standards Board.

Technical standards development activities represent a major component of the European Community's plan to integrate its economy by the end of 1992, with an EC policy to use international standards, if available, to implement its directives relating to health, safety and the environment. Furthermore, recent Congressional inquiries into the status of the United States' participation in international standards activities makes it appropriate to update information on the level of U.S. participation in ISO and IEC at this time.

1.2 Format

Section 2 provides current information on U.S. participation in ISO activities through technical committee (TC) secretariats and comparisons with similar levels in the earlier period. Information on IEC activities are summarized in Section 3. Section 4 highlights summary data on technical committee meetings and U.S. delegations to ISO and IEC Technical Committee meetings. Information on the make-up of the newly-established ISO/IEC Joint Technical Committee 1 on Information Technology is provided in Section 5. Section 6 lists the appendices, which provide specific information on technical committee secretariats held by member bodies for all ISO and IEC committees. Section 7 summarizes some conclusions resulting from this update.

2. ISO Updated Information - 1989

2.1 U.S.-Held ISO TC Secretariats (1989)

In 1989 the U.S. held 17 secretariats of the 166 ISO Technical Committees (10.2%), namely:

TC 11, Boilers and Pressure Vessels (since 1966)
TC 20, Aircraft and Space Vehicles
TC 28, Petroleum Products and Lubricants (since 1966)
TC 31, Tires, Rims and Valves
TC 36, Cinematography (since 1966)
TC 42, Photography (since 1966)
TC 61, Plastics (since 1966)

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[3] American National Standards Institute, 1430 Broadway, New York, NY 10018.

TC 67, Materials and Equipment for Petroleum and Natural Gas Industries
TC 68, Banking and Related Financial Services[4]
TC 104, Freight Containers (since 1966)
TC 108, Mechanical Vibration and Shock (since 1966)
TC 127, Earthmoving Machinery
TC 131, Fluid Power Systems
TC 153, Valves
TC 161, Control and Safety Devices for Non-Industrial Gas-Fired Appliances and Systems
TC 189, Ceramic Tile (since 1986)
TC 192, Gas Turbines (since 1988)

A new ISO-IEC Joint Technical Committee 1 (JTC 1) on Information Technology was established in 1987, with the United States holding the secretariat. The following ISO and IEC Technical Committees were integrated to form the new ISO/IEC JTC 1:

ISO TC 97, Information Processing Systems
IEC TC 83, Information Technology Equipment
IEC SC 47B, Microprocessor Systems

The U.S. previously held the secretariat of ISO TC 97.

The data in this section on ISO participation have been adjusted to reflect the exclusion of JTC 1. Summary data on JTC 1 are given in section 5 of this report.

2.2 U.S. Gains in ISO TC Secretariats (1986-1989)

The U.S. gained two secretariats:

TC 67, Materials and Equipment for Petroleum and Natural Gas Industries - previously held by Romania (IRS).

TC 192, Gas Turbines - a new technical committee established in 1988 from the previous TC 70, SC 6 - "Gas Turbines" of which ANSI held the SC secretariat.

2.3 U.S. Losses in ISO TC Secretariats (1986-1989)

None.

2.4 Comparison (1989 vis-à-vis 1986)

In 1986 the U.S. held 16 secretariats of the then 164 ISO Technical Committees (9.8%), compared to 17 secretariats of 166 ISO Technical Committees in 1989 (10.2%).

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[4] Committee title modified in 1988 to include financial services.

The following table summarizes the leadership positions in ISO Technical Committees (TC), Subcommittees (SC), and Working Groups (WG) held by the United States in 1986 and in 1989.

Secretariats of ISO Technical Committees, Subcommittees and Conveners of Working Groups, 1986-1989

	1986			1989[5]			1986-1989
	ISO Total	U.S. Total	% U.S. Held	ISO Total	U.S. Total	% U.S. Held	% Gain/Loss for U.S.
TC	164	16	9.8%	166	17	10.2%	+0.4%
SC	645	69	10.7	619	64	10.3	-0.4
WG	1556	212	13.6	1588	210	13.2	-0.4
Total	2365	297	12.6%	2373	291	12.2%	-0.4%

2.5 Level of U.S. Participation Status In ISO Technical Committees - 1986 & 1989

	1986		1989		
Status In Technical Committee	No.	%	No.	%	% change '86-'89
"P" - Participant	113	68.9%	112	67.1%	-1.8%
"O" - Observer	48	29.3	51	30.5	+1.2
NR-Not Represented	3	1.8	4	2.4	+0.6
Total	164		167		

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[5] 1989 data does not include ISO/IEC JTC 1 which was formed in 1987. See Section 5.

There was a net decrease (1.8%) for the U.S. in overall active participation levels from 1986-1989. "Observer" status increased as did the number of technical committees on which the U.S. had no representation.

NOTE: Data for the above tables were derived from official ISO Participation tables. There are nine ISO Technical Committees which are essentially dormant - with no new work activity underway - only a review function of ISO standards already published. These committees are:

TC 18, Zinc and Zinc Alloys
TC 19, Preferred Numbers (Note: This TC may become more active in near future)
TC 50, Lac
TC 56, Mica
TC 109, Oil Burners and Associated Equipment
TC 128, Glass Plant, Pipeline and Fittings
TC 142, Cleaning Equipment for Air and Other Gases
TC 144, Air Quality
TC 152, Gypsum, Gypsum Plasters and Gypsum Products

2.6 Changes in U.S. Participation Status in ISO, 1986-1989

(a) from "Participant" to "Observer" status:

TC 34, Agricultural Food Products
TC 111, Round Steel Link Chains, Lifting Hooks and Accessories
TC 123, Plain Bearings
TC 148, Sewing Machines
TC 181, Safety of Toys

(b) from "Observer" to "Participant" status:

TC 14, Shafts for Machinery and Accessories
TC 179, Masonry
TC 37, Terminology (principles and coordination) (see also (d) below)

(c) from "Not Represented" to "Participant" status:

TC 126, Tobacco and Tobacco Products

(d) ANSI anticipated changes from "Observer" to "Participant" status:

TC 55, Sawn Timber and Sawlogs
TC 59, Building Construction
TC 149, Cycles

2.7 U.S. Participation Status on Newly Formed ISO Technical

Committees (since 1986)

TC 192, Gas Turbines - "Participant" (also secretariat)
TC 193, Natural Gas - "Observer"
TC 194, Biological Testing of Medical and Dental materials and Devices - "Not Represented" (Note: A change to "Participant" status for both TC 193 and TC 194 has been initiated by ANSI.)

3. IEC Updated Information - 1989

3.1 U.S. - Held IEC TC and SC Secretariats (1989)

In 1989 the U.S. held 32 TC and SC secretariats (13 TC and 19 SC) of the 197 IEC Technical Committees and Subcommittees (16.2%) as follows:

SC2J: Classification of Insulation Systems for Rotating Machinery (since 1981)
TC4: Hydraulic Turbines (since 1966)
TC5: Steam Turbines (since 1974)
SC12F: Equipment Used in the Mobile Services (since 1972)
SC15B: Endurance Tests (since 1966)
SC15C: Specifications (since 1975)
SC22G: Semiconductor Power Converters for Adjustable Speed Electric Drive Systems (since 1982)
TC25: Quantities and Units, and Their Letter Symbols (since 1966)
SC31A: Flameproof Enclosures (since 1984)
SC31H: Apparatus for Use in the Presence of Ignitable Dust (since 1966)
TC37: Surge Arresters (since 1966)
TC46: Cables, Wires and Waveguides for Telecommunications Equipment (since 1971)
SC46B: Waveguides and Their Accessories (since 1966)
SC46D: Connectors for R.F. Cables (since 1982)
TC48: Electromechanical Components for Electronic Equipment (since 1968)
SC48B: Connectors (since 1968)
SC48C: Switches (since 1984)
TC52: Printed Circuits (since 1985)
SC59A: Electric Dishwashers (since 1966)
SC59H: Microwave Appliances (since 1972)
TC61: Safety of Household and Similar Electrical Appliances (since 1967)
SC61B: Safety of Household Microwave Ovens (since 1970)
SC61D: Appliances for Air-conditioning for Household and Similar Purposes (since 1973)
SC62D: Electromedical Equipment (since 1970)
SC65B: Elements of Systems (since 1973)
SC66D: Analyzing Equipment (since 1975)

TC72: Automatic Controls for Household Use (since 1971)
TC74: Safety of Data Processing Equipment and Office Machines (since 1973)
TC76: Laser Equipment (since 1973)
TC82: Solar Photovoltaic Energy Systems (since 1982)
TC86: Fibre Optics (since 1985)
CISPR/SCA:[6] Radio Interference Measurements and Statistical Methods (since 1975)

3.2 U.S. Gains in IEC Secretariats (1986-1989)

None

3.3 U.S. Losses in IEC Secretariats (1986-1989)

IEC/SC 61 G on "Safety of Projectors" was formally disbanded by IEC in 1988. The U.S. had held the secretariat of this Subcommittee since 1983.

3.4 Comparison

The following table summarizes the leadership positions in IEC Technical Committees (TC) and Subcommittees (SC) held by the United States in 1986 and in 1989. Total IEC TC and SC's decreased from 200 to 197 over the 3-year period.

Secretariats of IEC Technical Committees and Subcommittees, 1986 - 1989

	1986			1989			
	IEC Total	US Total	% US Held	IEC Total	US Total	% US Held	1986-1989 % Gain Loss
TC	83	13	15.7%	83	13	15.7%	-
SC	117	20	17.1%	114	19	16.7%	-0.4%
Total	200	33	16.5%	197	32	16.2%	-0.3%

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[6] CISPR is the IEC sponsored "International Special Committee on Radio Interference." Sub-Committee A covers "CISPR Radio interference measurements and statistical methods." There are six other CISPR subcommittees covering different forms of radio interference suppression.

3.5 Newly Established IEC Committees

Three new IEC Technical Committees were established during the period. The new IEC Committees and the country holding the secretariat position are as follows:

TC87: Ultrasonics (Secretariat: USSR)
TC88: Safety of windturbine generator systems (Secretariat: Netherlands)
TC89: Fire hazard testing (provisional title) (Secretariat: Federal Republic of Germany)

4. Levels of Involvement - ANSI Delegations to ISO and IEC Meetings

4.1 ISO Standards Committee Meetings - CY 1966-1988

The following information is based on estimates provided by ANSI and applies to ISO and IEC meetings at the technical committee and subcommittee levels.

	CY'86	CY'88	Differences 86-88
No. of U.S. Delegates	466	753	+287
No. of ISO Meetings Held	132	140	+ 8
No. of U.S. Hosted Meetings	7	15	+ 8
U.S. Delegates/ISO Meeting	3.5	5.4	+1.9

4.2 IEC Standards Committee Meetings - CY1966 and 1988

	CY'86	CY'88	Differences 86-88
No. of U.S. Delegates	143	175	+32
No. of IEC Meetings Held	45	56	+13
No. of U.S. Hosted Meetings	4	4	0
U.S. Delegates/IEC Meeting	3.2	3.1	-0.1

5. Information on ISO/IEC Joint Technical Committee 1 on Information Technology

As indicated earlier, ISO/IEC JTC 1 was established in 1987, the first Joint Committee ever convened by ISO and IEC acting together. The United States administers the international secretariat of JTC 1 and holds 4 of the 16 Subcommittee

Secretariats and 20 of the 71 Working Group Secretariats in JTC 1. The overall distribution of secretariats among member bodies is given in the following table.

ISO/IEC Joint Technical Committee 1
Distribution of Technical Secretariats

SECRETARIATS Member body		SC	WG	Total
AFNOR	France	2	7	9
ANSI	USA	4	20	24
BSI	United Kingdom	1	11	12
DIN	Germany, F.R.	3	5	8
JISC	Japan	2	2	4
NNI	Netherlands	1	1	2
SCC	Canada	2	10	12
SIS	Sweden	1	2	3
SNV	Switzerland	0	4	4
Sub-committees and working groups which have no secretariat			9	9
Total		16	71	87

The organizational structure, functional area of responsibility, title, and country holding the Secretariat of each JTC 1 Subcommittee are shown in Figure 1.

6. Distribution of ISO and IEC Technical Committee Secretariats

The following appendices cover the ISO and IEC Technical Committees and identify the country holding each secretariat.

Appendix A - ISO Secretariats

Appendix B - Distribution of ISO Technical Committee Secretariats by Country

Appendix C - IEC Secretariats

Appendix D - Distribution by Country for Secretariats of IEC Technical Committees and Sub-Committees

7. Summary

The United States has a dominant position in the new ISO/IEC Joint Technical Committee 1 on "Information Technology," with 29% of the 91 committee secretariats available including the international secretariat of the overall joint committee and five of its major subcommittees. Secretariats held by the United States in the ISO remained at approximately 12%, and in IEC at about 16%, about the same levels as in the 1986 review. In contrast, the Western European countries (i.e., those making up the EC[7] and EFTA[8] countries) together hold 67% of the ISO secretariats and 69% of the IEC secretariats.

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[7] The Member States of the European Community include Belgium, Denmark, France, Germany (F.R.), Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom.

[8] The Member States of the European Free Trade Association (EFTA) include Austria, Finland, Iceland, Norway, Sweden and Switzerland.

ORGANIZATION CHART
FOR
ISO/IEC JOINT TECHNICAL COMMITTEE 1
(JTC1)
INFORMATION TECHNOLOGY

June 1989

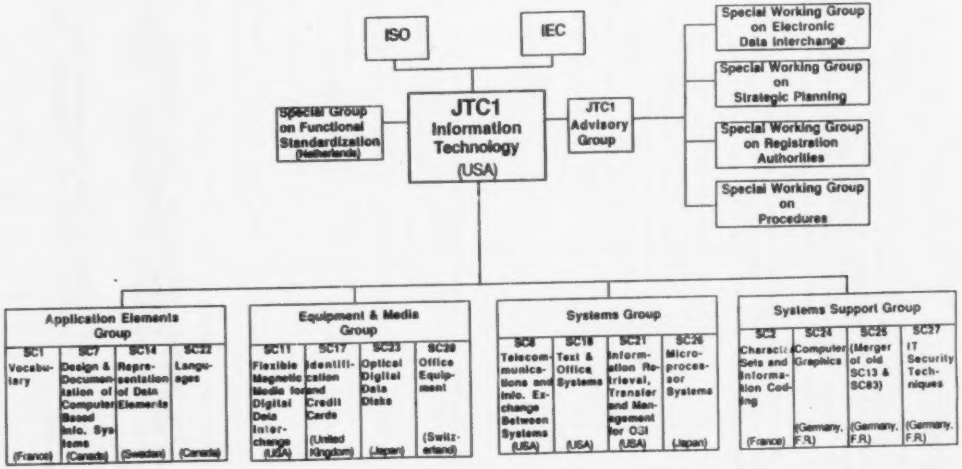
ISO
IEC
Special Group on Functional Standardization (Netherlands)
JTC1 Information Technology (USA)
JTC1 Advisory Group
Special Working Group on Electronic Data Interchange
Special Working Group on Strategic Planning
Special Working Group on Registration Authorities
Special Working Group on Procedures
Application Elements Group
SC1 Vocabulary (France)
SC7 Design & Documentation of Computer Based Info. Systems (Canada)
SC14 Representation of Data Elements (Sweden)
SC22 Languages (Canada)
Equipment & Media Group
SC11 Flexible Magnetic Media for Digital Data Interchange (USA)
SC17 Identification and Credit Cards (United Kingdom)
SC23 Optical Digital Data Disks (Japan)
SC28 Office Equipment (Switzerland)
Systems Group
SC6 Telecommunications and Info. Exchange Between Systems (USA)
SC18 Text & Office Systems (USA)
SC21 Information Retrieval, Transfer and Management for OSI (USA)
SC26 Microprocessor Systems (Japan)
Systems Support Group
SC2 Character Sets and Information Coding (France)
SC24 Computer Graphics (Germany, F.R)
SC25 (Merger of old SC13 & SC83) (Germany, F.R)
SC27 IT Security Techniques (Germany, F.R)

Figure 1.

ISO SECRETARIATS

APPENDIX A

ISO TECHNICAL COMMITTEES NO.	TITLE	COUNTRY HOLDING SECRETARIAT
1	Screw threads	SWEDEN
2	Fasteners	GERMANY, F.R.
3	Limits and fits	GERMANY, F.R.
4	Rolling bearings	SWEDEN
5	Ferrous metal pipes and metallic fittings	SWITZERLAND
6	Paper, board and pulps	CANADA
8	Shipbuilding and marine structures	NETHERLANDS
10	Technical drawings	GERMANY, F.R.
11	Boilers and pressure vessels	UNITED STATES
12	Quantities, units, symbols, conversion factors and conversion tables	SWEDEN
14	Shafts for machinery and accessories	BELGIUM
17	Steel	JAPAN
18	Zinc and zinc alloys	dormant
19	Preferred numbers	dormant
20	Aircraft and space vehicles	UNITED STATES
21	Equipment for fire protection and fire fighting	UNITED KINGDOM
22	Road vehicles	FRANCE
23	Tractors and machinery for agriculture and forestry	FRANCE
24	Sieves, sieving and other sizing methods	GERMANY, F.R.
25	Cast iron and pig iron	UNITED KINGDOM
26	Copper and copper alloys	GERMANY, F.R.
27	Solid mineral fuels	UNITED KINGDOM
28	Petroleum products and lubricants	UNITED STATES
29	Small tools	FRANCE
30	Measurement of fluid flow in closed conduits	FRANCE
31	Tyres, rims and valves	UNITED STATES
33	Refractories	UNITED KINGDOM
34	Agricultural food products	HUNGARY
35	Paints and varnishes	NETHERLANDS
36	Cinematography	UNITED STATES
37	Terminology (principles and co-ordination)	AUSTRIA
38	Textiles	UNITED KINGDOM
39	Machine tools	ITALY
41	Pulleys and belts (including veebelts)	FRANCE
42	Photography	UNITED STATES
43	Acoustics	DENMARK
44	Welding and allied processes	FRANCE
45	Rubber and rubber products	UNITED KINGDOM
46	Information and documentation	GERMANY, F.R.
47	Chemistry	NETHERLANDS
48	Laboratory glassware and related apparatus	USSR
50	Lac	dormant
51	Pallets for unit load method of materials handling	UNITED KINGDOM
52	Light gauge metal containers	FRANCE
54	Essential oils	PORTUGAL
55	Sawn timber and sawlogs	USSR
56	Mica	dormant
57	Metrology and properties of surfaces	USSR
58	Gas cylinders	SWEDEN
59	Building construction	vacant
60	Gears	BELGIUM
61	Plastics	UNITED STATES
63	Glass containers	CZECHOSLOVAKIA
66	Manganese and chromium ores	USSR

ISO TECHNICAL COMMITTEES		COUNTRY HOLDING SECRETARIAT
NO.	TITLE	
67	Materials and equipment for petroleum and natural gas industries	UNITED STATES
68	Banking and related financial services	UNITED STATES
69	Application of statistical methods	FRANCE
70	Internal combustion engines	UNITED KINGDOM
71	Concrete, reinforced concrete and pre-stressed concrete	AUSTRIA
72	Textile machinery and allied machinery and accessories	SWITZERLAND
74	Cement and lime	BELGIUM
76	Transfusion, infusion and injection equipment for medical use	GERMANY, F.R.
77	Products in fibre reinforced cement	SWITZERLAND
79	Light metals and their alloys	FRANCE
81	Common names for pesticides and other agrochemicals	UNITED KINGDOM
82	Mining	GERMANY, F.R.
83	Sports and recreational equipment	GERMANY, F.R.
84	Syringes for medical use and needles for injections	FRANCE
85	Nuclear energy	GERMANY, F.R.
86	Refrigeration	USSR
87	Cork	PORTUGAL
89	Wood-based panels	GERMANY, F.R.
91	Surface active agents	FRANCE
92	Fire tests on building materials, components and structures	UNITED KINGDOM
93	Starch (including derivatives and by-products)	FRANCE
94	Personal safety — Protective clothing and equipment	UNITED KINGDOM
96	Cranes, lifting appliances and related equipment	AUSTRALIA
98	Bases for design of structures	POLAND.
99	Semi-manufactures of timber	USSR
100	Chains and chain wheels for power transmission and conveyor	UNITED KINGDOM
101	Continuous mechanical handling equipment	FRANCE
102	Iron ores	JAPAN
104	Freight containers	UNITED STATES
105	Steel wire ropes	UNITED KINGDOM
106	Dentistry	UNITED KINGDOM
107	Metallic and other inorganic coatings	ITALY
108	Mechanical vibration and shock	UNITED STATES
109	Oil burners and associated equipment	dormant
110	Industrial trucks	GERMANY, F.R.
111	Round steel link chains, lifting hooks and accessories	UNITED KINGDOM
112	Vacuum technology	USSR
113	Measurement of liquid flow in open channels	INDIA
114	Horology	SWITZERLAND
115	Pumps	FRANCE
116	Space heating appliances	UNITED KINGDOM
117	Industrial fans	FRANCE
118	Compressors, pneumatic tools and pneumatic machines	SWEDEN
119	Powder metallurgy	SWEDEN
120	Leather	INDIA
121	Anaesthetic and respiratory equipment	UNITED KINGDOM
122	Packaging	— vacant —
123	Plain bearings	USSR
125	Enclosures and conditions for testing	AUSTRALIA
126	Tobacco and tobacco products	GERMANY, F.R.
127	Earth-moving machinery	UNITED STATES
128	Glass plant, pipeline and fittings	dormant
129	Aluminium ores	FRANCE
130	Graphic technology	GERMANY, F.R.
131	Fluid power systems	UNITED STATES
132	Ferroalloys	USSR

APPENDIX A

ISO TECHNICAL COMMITTEES NO.	TITLE	COUNTRY HOLDING SECRETARIAT
133	Sizing systems and designations for clothes	SOUTH AFRICA
134	Fertilizers and soil conditioners	FRANCE
135	Non-destructive testing	USSR
136	Furniture	SWEDEN
137	Sizing system, designations and marking for boots and shoes	SOUTH AFRICA
138	Plastics pipes, fittings and valves for the transport of fluids	NETHERLANDS
142	Cleaning equipment for air and other gases	dormant
144	Air distribution and air diffusion	dormant
145	Graphical symbols	GERMANY, F.R.
146	Air quality	GERMANY, F.R.
147	Water quality	GERMANY, F.R.
148	Sewing machines	GERMANY, F.R.
149	Cycles	INDIA
150	Implants for surgery	GERMANY, F.R.
152	Gypsum, gypsum plasters and gypsum products	dormant
153	Valves	UNITED STATES
154	Documents and data elements in administration, commerce and industry	SWEDEN
155	Nickel and nickel alloys	CANADA
156	Corrosion of metals and alloys	USSR
157	Mechanical contraceptives	SWEDEN
158	Analysis of gases	FRANCE
159	Ergonomics	GERMANY, F.R.
160	Glass in building	UNITED KINGDOM
161	Control and safety devices for non-industrial gas-fired appliances and systems	UNITED STATES
162	Doors and windows	NORWAY
163	Thermal insulation	SWEDEN
164	Mechanical testing of metals	JAPAN
165	Timber structures	DENMARK
166	Ceramic ware, glassware and glass ceramic ware in contact with food	ISRAEL
167	Steel and aluminium structures	NORWAY
168	Prosthetics and orthotics	GERMANY, F.R.
170	Surgical instruments	GERMANY, F.R.
171	Micrographics and optical memories for document and image recording, storage and use	FRANCE
172	Optics and optical instruments	GERMANY, F.R.
173	Technical systems and aids for disabled or handicapped persons	SWEDEN
174	Jewellery	GERMANY, F.R.
175	Fluorspar	SOUTH AFRICA
176	Quality management and quality assurance	CANADA
177	Caravans	UNITED KINGDOM
178	Lifts, escalators, passenger conveyors	FRANCE
179	Masonry	GERMANY, F.R.
180	Solar energy	AUSTRALIA
181	Safety of toys	DENMARK
182	Geotechnics	NETHERLANDS
183	Copper, lead and zinc ores and concentrates	AUSTRALIA
184	Industrial automation systems	FRANCE
185	Safety devices for protection against excessive pressure	UNITED KINGDOM
186	Cutlery and table and decorative metal hollow-ware	UNITED KINGDOM
187	Colour notations	SWEDEN
188	Small craft	SWEDEN
189	Ceramic tile	UNITED STATES
190	Soil quality	NETHERLANDS
191	Humane animal (mammal) traps	CANADA
192	Gas turbines	UNITED STATES
193	Natural gas	NETHERLANDS
194	Biological testing of medical and dental materials and devices	GERMANY, F.R.

APPENDIX B

Distribution of ISO Technical Committee Secretariats by Country

ISO Technical Committees

SECRETARIATS Member body		TC	SC	WG	Total
ABNT	Brazil		2	2	4
AENOR	Spain		3	6	9
AFNOR	France	24	101	226	351
ANSI	USA	17	64	210	291
BDS	Bulgaria		1		1
BIS	India	5	16	4	25
BSI	United Kingdom	23	88	289	400
CSBTS	China		2	1	3
CSN	Czechoslovakia	1	3	6	10
DIN	Germany, F.R.	27	113	297	437
DS	Denmark	3	4	28	35
GOST	USSR	11	33	12	56
IBN	Belgium	4	8	20	32
ICONTEC	Colombia			1	1
IPQ	Portugal	2		5	7
JISC	Japan	3	10	27	40
MSZH	Hungary	1	1	2	4
NNI	Netherlands	7	15	52	74
NSF	Norway	2	9	10	21
ON	Austria	2	4	17	23
PKNMiJ	Poland	1	4	5	10
PNGS	Papua New Guinea			1	1
SAA	Australia	4	3	31	38
SABS	South Africa, Rep. of	3	2	3	8
SANZ	New Zealand		1		1
SCC	Canada	4	24	57	85
SFS	Finland		3	8	11
SII	Israel	1	1	3	5
SIRIM	Malaysia			2	2
SIS	Sweden	13	19	66	98
SNV	Switzerland	4	20	21	45
TBS	Tanzania		1		1
TSE	Turkey		3		3
UNI	Italy	2	21	42	65
Technical committees, sub-committees and working groups which have no secretariat		2	40	134	176
Total		166	619	1588	2373

NOTE: The EC countries hold 68 TC Secretariats and 249 SC secretariats. Source: ISO Memento, 1989

APPENDIX C

IEC SECRETARIATS

IEC TECHNICAL COMMITTEES AND SUB COMMITTEES NO.	TITLE	COUNTRY HOLDING SECRETARIAT
1:	Terminology	FRANCE
2:	Rotating machinery	UNITED KINGDOM
2A:	Turbine-type generators	USSR
2B:	Mounting dimensions and output series	FRANCE
2G:	Test methods and procedures	USSR
2H:	Degrees of protection, methods of cooling and mounting arrangements	FRANCE
2J:	Classification of insulation systems for rotating machinery	UNITED STATES
3:	Documentation and graphical symbols	SWITZERLAND
3A:	Graphical symbols for diagrams	SWITZERLAND
3B:	Documentation	SWEDEN
3C:	Graphical symbols for use on equipment	FRANCE
4:	Hydraulic turbines	UNITED STATES
5:	Steam turbines	UNITED STATES
7:	Bare aluminium conductors	BRAZIL
8:	Standard voltages, current ratings and frequencies	ITALY
9:	Electric traction equipment	FRANCE
10:	Fluids for electrotechnical applications	BELGIUM
11:	Recommendations for overhead lines	FRANCE
12:	Radiocommunications	NETHERLANDS
12A:	Receiving equipment	JAPAN
12B:	Safety	NETHERLANDS
12C:	Transmitting equipment	FRANCE
12D:	Aerials (antennas)	— disbanded —
12E:	Radio relay and fixed satellite communications systems	CZECHOSLOVAKIA
12F:	Equipment used in the mobile services	UNITED STATES
12G:	Cabled distribution systems	CANADA
13:	Equipment for electrical energy measurement and load control	HUNGARY
14:	Power transformers	UNITED KINGDOM
14B:	On-load tap changers	UNITED KINGDOM
14C:	Reactors	GERMANY, F.R.
14D:	Small power transformers and reactors and special transformers and reactors	FRANCE
15:	Insulating materials	ITALY
15A:	Short-time tests	GERMANY, F.R.
15B:	Endurance tests	UNITED STATES
15C:	Specifications	UNITED STATES
16:	Terminal markings and other identifications	GERMANY, F.R.
17:	Switchgear and controlgear	SWEDEN
17A:	High-voltage switchgear and controlgear	SWEDEN
17B:	Low-voltage switchgear and controlgear	FRANCE
17C:	High-voltage enclosed switchgear and controlgear	GERMANY, F.R.
17D:	Low-voltage switchgear and controlgear assemblies	GERMANY, F.R.
18:	Electrical installations in ships	NETHERLANDS
18A:	Cables and cable installations	ITALY
20:	Electric cables	UNITED KINGDOM
20A:	High-voltage cables	UNITED KINGDOM
20B:	Low-voltage cables	NETHERLANDS
21:	Secondary cells and batteries	CZECHOSLOVAKIA
21A:	Alkaline secondary cells and batteries	GERMANY, F.R.
22:	Power electronics	SWITZERLAND
22B:	Semiconductor convertors	SWEDEN
22D:	Electronic power convertors for rolling stock	FRANCE
22E:	Stabilized power supplies	SWITZERLAND
22F:	Convertors for high-voltage d.c. power transmission	USSR
22G:	Semiconductor power convertors for adjustable speed electric drive systems	UNITED STATES
23:	Electrical accessories	BELGIUM

IEC TECHNICAL COMMITTEES AND SUBCOMMITTEES		COUNTRY HOLDING SECRETARIAT
NO.	TITLE	
23A:	Conduits for electrical purposes	UNITED KINGDOM
23B:	Plugs, socket-outlets and switches	ITALY
23C:	World-wide plug and socket-outlet systems	SOUTH AFRICA
23E:	Circuit-breakers and similar equipment for household use	ITALY
23F:	Connecting devices	FRANCE
23G:	Appliance couplers	SWEDEN
23H:	Industrial plugs and socket-outlets	FRANCE
23J:	Switches for appliances	GERMANY, F.R.
25:	Quantities and units, and their letter symbols	UNITED STATES
26:	Electric welding	GERMANY, F.R.
27:	Industrial electroheating equipment	USSR
28:	Insulation co-ordination	FRANCE
28A:	Insulation co-ordination for low-voltage equipment	GERMANY, F.R.
31:	Electrical apparatus for explosive atmospheres	UNITED KINGDOM
31A:	Flameproof enclosures	UNITED STATES
31B:	Sand-filled apparatus	FRANCE
31C:	Increased safety apparatus	UNITED KINGDOM
31D:	Pressurization and associated techniques	FRANCE
31G:	Intrinsically-safe apparatus	UNITED KINGDOM
31H:	Apparatus for use in the presence of ignitable dust	UNITED STATES
31J:	Classification of hazardous areas and installation requirements	YUGOSLAVIA
32:	Fuses	FRANCE
32A:	High-voltage fuses	FRANCE
32B:	Low-voltage fuses	GERMANY, F.R.
32C:	Miniature fuses	GERMANY, F.R.
33:	Power capacitors	ITALY
34:	Lamps and related equipment	UNITED KINGDOM
34A:	Lamps	UNITED KINGDOM
34B:	Lamp caps and holders	NETHERLANDS
34C:	Auxiliaries for discharge lamps	UNITED KINGDOM
34D:	Luminaires	UNITED KINGDOM
35:	Primary cells and batteries	NETHERLANDS
36:	Insulators	ITALY
36A:	Insulated bushings	ITALY
36B:	Insulators for overhead lines	FRANCE
36C:	Insulators for sub-stations	SWEDEN
37:	Surge arresters	UNITED STATES
38:	Instrument transformers	UNITED KINGDOM
39:	Electronic tubes	NETHERLANDS
40:	Capacitors and resistors for electronic equipment	NETHERLANDS
41:	Electrical relays	FRANCE
41A:	All-or-nothing relays	FRANCE
41B:	Measuring relays and protection equipment	FRANCE
42:	High-voltage testing techniques	CANADA
43:	Electric fans for household and similar purposes	INDIA
44:	Electrical equipment of industrial machines	UNITED KINGDOM
45:	Nuclear instrumentation	USSR
45A:	Reactor instrumentation	FRANCE
45B:	Radiation protection instrumentation	ITALY
46:	Cables, wires and waveguides for telecommunication equipment	UNITED STATES
46A:	R.F. cables	UNITED KINGDOM
46B:	Waveguides and their accessories	UNITED STATES
46C:	L.F. cables and wires	FRANCE
46D:	Connectors for R.F. cables	UNITED STATES
47:	Semiconductor devices	FRANCE
47A:	Integrated circuits	FRANCE
47B:	Microprocessor systems	JAPAN
48:	Electromechanical components for electronic equipment	UNITED STATES
48B:	Connectors	UNITED STATES

APPENDIX C

IEC TECHNICAL COMMITTEES AND SUBCOMMITTEES		COUNTRY HOLDING SECRETARIAT
NO.	TITLE:	
48C:	Switches	UNITED STATES
48D:	Mechanical structures for electronic equipment	GERMANY, F.R.
49:	Piezoelectric devices for frequency control and selection	USSR
50:	Environmental testing	UNITED KINGDOM
50A:	Shock and vibration tests	UNITED KINGDOM
50B:	Climatic tests	NETHERLANDS
50D:	Fire hazard testing	GERMANY
51:	Magnetic components and ferrite materials	UNITED KINGDOM
52:	Printed circuits	UNITED STATES
55:	Winding wires	FRANCE
56:	Reliability and maintainability	SWEDEN
57:	Telecontrol, teleprotection and associated telecommunications for electric power systems	GERMANY, F.R.
58:	Methods of measurement of electrical properties of metallic materials	To be appointed
59:	Performance of household electrical appliances	FRANCE
59A:	Electric dishwashers	UNITED STATES
59B:	Cooking appliances	To be appointed
59C:	Heating appliances	FRANCE
59D:	Home laundry appliances	FRANCE
59E:	Ironing and pressing appliances	JAPAN
59F:	Floor treatment appliances	SWEDEN
59G:	Small kitchen machines	ITALY
59H:	Microwave appliances	UNITED STATES
59J:	Hand-held electric tools	FRANCE
60:	Recording	NETHERLANDS
60A:	Sound recording	BELGIUM
60B:	Video recording	GERMANY, F.R.
61:	Safety of household and similar electrical appliances	UNITED STATES
61B:	Safety of household microwave ovens	UNITED STATES
61C:	Household appliances for refrigeration	FRANCE
61D:	Appliances for air-conditioning for household and similar purposes	UNITED STATES
61E:	Safety of electrical commercial catering equipment	SOUTH AFRICA
61F:	Safety of hand-held motor-operated tools	ITALY
61G:	Safety of projectors	— disbanded —
61H:	Safety of electrically-operated farm appliances	NEW ZEALAND
61J:	Electrical motor-operated cleaning appliances for industrial use	GERMANY, F.R.
62:	Electrical equipment in medical practice	GERMANY, F.R.
62A:	Common aspects of electrical equipment used in medical practice	FRANCE
62B:	X-ray equipment operating up to 400 kV and accessories	GERMANY, F.R.
62C:	High-energy radiation equipment and equipment for nuclear medicine	SWITZERLAND
62D:	Electromedical equipment	UNITED STATES
63:	Insulation systems	USSR
64:	Electrical installations of buildings	GERMANY, F.R.
65:	Industrial-process measurement and control	FRANCE
65A:	System considerations	UNITED KINGDOM
65B:	Elements of systems	UNITED STATES
65C:	Digital data communications for measurement and control systems	UNITED KINGDOM
66:	Measuring equipment for electronic techniques	HUNGARY
66D:	Analysing equipment	UNITED STATES
66E:	Safety of measuring, control and laboratory equipment	UNITED KINGDOM
68:	Magnetic alloys and steels	GERMANY, F.R.
69:	Electric road vehicles and electric industrial trucks	SWEDEN
70:	Degrees of protection by enclosures	GERMANY, F.R.
71:	Electrical installations for outdoor sites under heavy conditions (including open-cast mines and quarries)	AUSTRALIA
72:	Automatic controls for household use	UNITED STATES
73:	Short-circuit currents	NORWAY
74:	Safety of data processing equipment and office machines	UNITED STATES
75:	Classification of environmental conditions	SWEDEN
76:	Laser equipment	UNITED STATES

IEC TECHNICAL COMMITEES AND SUBCOMMITTEES NO.	TITLE	COUNTRY HOLDING SECRETARIAT
77:	Electromagnetic compatibility between electrical equipment including networks	GERMANY, F.R.
77A:	Equipment for connection to the public low-voltage supply system	FRANCE
77B:	Industrial and other non-public networks and equipment connected thereto	To be appointed
78:	Tools for live working	CANADA
79:	Alarm systems	BELGIUM
80:	Navigational instruments	UNITED KINGDOM
81:	Lightning protection	ITALY
82:	Solar photovoltaic energy systems	UNITED STATES
83:	Information technology equipment	—
84:	Equipment and systems in the field of audio, video and audiovisual engineering	NETHERLANDS
85:	Measuring equipment for basic electrical quantities	HUNGARY
86:	Fibre optics	UNITED STATES
86A:	Fibres and cables	UNITED KINGDOM
86B:	Fibre optic interconnecting devices and passive components	FRANCE
87:	Ultrasonics	USSR
88:	Wind-turbine generator system	NETHERLANDS
International Special Committee on Radio Interference (C.I.S.P.R.)		UNITED KINGDOM
Sub-Committee A of C.I.S.P.R.:	Radio interference measurements and statistical methods	UNITED STATES
Sub-Committee B of C.I.S.P.R.:	Interference from industrial, scientific and medical radio-frequency apparatus	JAPAN
Sub-Committee C of C.I.S.P.R.:	Interference from overhead power lines, high-voltage equipment and electric traction systems	ITALY
Sub-Committee D of C.I.S.P.R.:	Interference relating to motor vehicles and internal-combustion engines	GERMANY, F.R.
Sub-Committee E of C.I.S.P.R.:	Interference characteristics of radio receivers	ITALY
Sub-Committee F of C.I.S.P.R.:	Interference from motors, household appliances, lighting apparatus and the like	NETHERLANDS
Sub-Committee G of C.I.S.P.R.:	Interference characteristics of information technology equipment	GERMANY, F.R.

APPENDIX D

Distribution by Country for Secretariats of IEC Technical Committees and Sub-Committees

	Total Held
France	35
United States	32
United Kingdom	26
Germany, F.R.	25
Italy	15
Netherlands	14
Sweden	10
USSR	9
Switzerland	5
Belgium	4
Canada	3
Hungary	3
Japan	3
South Africa	2
Czechoslovakia	2
Australia	1
Brazil	1
Denmark	1
India	1
Norway	1
New Zealand	1
Yugoslavia	1
(Vacant)	2
TOTAL	197

NOTE: EC countries hold a total of 120 secretariats.
Source: 1989 IEC Directory

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10. SUPPLEMENTARY NOTES

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11. ABSTRACT (A 200-WORD OR LESS FACTUAL SUMMARY OF MOST SIGNIFICANT INFORMATION. IF DOCUMENT INCLUDES A SIGNIFICANT BIBLIOGRAPHY OR LITERATURE SURVEY, MENTION IT HERE.)

This report presents updated information on the current level of U.S. participation in the two major international standardization bodies; ISO and IEC. Data on the new ISO/IEC Joint Technical Committee 1 (JTC 1) on Information Technology are also presented.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

American National Standards Institute; European Community; international standards; participation; standardization; U.S. exports

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ELECTRONIC FORM

AFTERNOON SESSION

Mr. **WALGREN.** Let me call us back to what must seem a cumbersome process to everyone, and I apologize for it.

Our last panel: Mr. Harry Lunt from the Corporate Consulting Engineering Department of Materials Engineering, Burns and Roe Enterprises; Michael Miller, Executive Director, the Association for Advancement of Medical Instrumentation; and Raymond Weser, Director, Westinghouse Corporation, For Strategic Resources focus.

Gentlemen, welcome to the Committee. We appreciate your patience and apologize for the inconveniences. Your written statements will be incorporated in the record, so you can feel free to take from them, or highlight in whatever way you would like to, points that you feel deserve to be made for the public record, and we appreciate your participating with us in this pursuit.

Let's go througn the panel in the order in which I introduced you to the record, and we will start with Mr. Lunt.

STATEMENTS OF HARRY LUNT, CORPORATE CONSULTING ENGINEER, MATERIALS ENGINEERING, BURNS AND ROE ENTERPRISES, ORADELL, NEW JERSEY; MICHAEL J. MILLER, EXECUTIVE DIRECTOR, ASSOCIATION FOR ADVANCEMENT OF MEDICAL INSTRUMENTATION, ARLINGTON, VIRGINIA; AND RAYMOND WESER, DIRECTOR, WESTINGHOUSE CORPORATION, STRATEGIC RESOURCES, EUROPE, AFRICA AND THE MIDDLE EAST, PITTSBURGH, PENNSYLVANIA

Mr. **LUNT.** Thank you, Mr. Chairman.

My name is Harry Lunt. I'm a consulting metallurgist with Burns and Roe Enterprises, a consulting engineering firm with headquarters in New Jersey. I also serve at the present time as chairman of an ASTM committee, the American Society for Testing and Materials Committee A-1 on Steel, Stainless Steel, and Related Alloys. This ASTM committee that I chair is running out of money for administering our activities in the international standards area. A subcommittee of my committee performs the tasks associated with representing the United States in technical committee—in ISO Technical Committee 17 on Steel. If the U.S. is to continue to make its presence known in ISO Technical Committee 17, we in my subcommittee must find additional sources of funds.

My ASTM committee was requested by the American National Standards Institute, ANSI, to serve as the technical advisory group for matters pertaining to steel in the International Standards Organization. We provide the experts, we provide the delegates, and we advise ANSI how to vote; ANSI has the vote.

We have the secretariats of two of the ISO subcommittees in steel, one on sheet steel and one on steel castings, and the one on sheet steel is of particular importance because sheet steel is the highest volume, the highest tonnage item in the world, the tonnage product in steel, so we feel this activity is very important, and principally through the operation of these two secretariats we have been successful in these areas in influencing the course of the development of ISO standards to be compatible with American technology.

There are other standards for steel products that are not compatible with American technology, particularly the steel products pertaining to pressure vessel applications. The ISO standards for pressure vessel plates and forgings are patterned after the Europeans standards. They more conform to the German and the British pressure vessel codes and are incompatible with the boiler and pressure vessel code used in the United States and most of North and South America, the ASME boiler and pressure vessel code.

So we have been successful in some areas; we are grossly outvoted in other areas.

The item I wish to call the committee's attention today is funding. In past years, the principal source of funding has been the American Iron and Steel Institute, AISI, a trade association of steel companies. AISI provided the funds for travel of U.S. delegates to meetings, and they also covered the costs associated with the operation of the secretariat on sheet steel. Another trade association, the Steel Founders Society of America, continues to fund our ISO activities in that area.

Although funding by the trade associations provides the needed money, it has a major drawback, it's not democratic. When ISO funds for ISO—when AISI funds for ISO travel were available, they could be used only by members of AISI—that is, only producer representatives. Thus, participation was producer-oriented. The Steel Founders Society of America continues to impose similar restrictions on its funding.

In 1986, AISI ceased funding ISO activities, and this loss of the industry support was of great concern to us. It appeared that we would have to give up our secretariat of sheet steel and perhaps give up our voting membership and accept a lower, nonvoting membership in the area of steel.

Therefore, my—this was highly undesirable, and my committee determined that we would have to raise the money ourselves. If were not successful, we would have to relinquish the secretariat and accept the nonvoting status in ISO. We approached the—we developed a plan which we submitted to the ASTM board of directors, and the board approved the plan. We attempted to solicit money from American industry. We were partially successful.

It may sound romantic if I say that the Army came to our rescue, but that's just what happened. People from the Materials Technology Laboratory in Watertown, Massachusetts, part of the U.S. Army Laboratory Command, have been long-time participants in ASTM and in Committee A-1, and they have been active in the activities of the technical advisory group on steel.

In the ASTM committee, their interest is to get agreement on modification to certain ASTM standards so that they can be used by the Department of Defense in procurement in place of military standards, and over the last few years quite a number of military standards have been withdrawn in place of ASTM standards. This is an ongoing process.

Similarly, they are interested in our ISO activities because of the desirability of having ISO standards available for Department of Defense procurement if they meet American needs. With this source of funding, we have been permitted to continue the operation of the sheet steel secretariat.

However, we are concerned for the future, because the Materials Technology Laboratory in Watertown is on the list of Army facilities to be closed. The closure of the laboratory, we feel, is likely to be the death knell of our DOD support.

Our financial support from American industry has started out quite modest and is approaching the vanishing point at the present time. So this is a major source of concern for us. We would like to see Federal money made available in the steel area to ASTM, who administers the funds for ISO activities, for use in the development of—continued development of ISO standards for steel.

I thank you.

[The prepared statement of Mr. Lunt follows:]

Testimony of

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ASTM Committee A-1 on Steel,
Stainless Steel and Related Alloys

UNITED STATES PARTICIPATION IN THE DEVELOPMENT OF INTERNATIONAL STANDARDS FOR STEEL

United States House of Representatives
Committee on Science, Space, and Technology
Subcommittee on Science, Research and Technology

July 25, 1989

Burns and Roe Enterprises, Inc.

Harry E. Lunt
Corporate Consulting Engineer
Materials Engineering
Burns and Roe Enterprises, Inc.

Mr. Lunt has 38 years experience in materials for power generation. A licensed Professional Engineer in the states of Delaware and California, he provides consulting services in materials engineering, metallurgy and welding. He was awarded the B.A. degree magna cum laude by Syracuse University where he was elected to the Phi Beta Kappa Honorary Society, and a Master of Science degree by Iowa State University.

At the present time, Mr. Lunt serves as Chairman of ASTM Committee A-1 on Steel, Stainless Steel and Related Alloys.

Mr. Lunt has been with Burns and Roe for about 15 years. Formerly, he was with the Worthington Corporation where he served as Corporate Materials Engineer reporting to the Vice President of Engineering, and before that was with the Westinghouse Research Laboratories and with the United States Steel Corporation.

BURNS AND ROE ENTERPRISES, INC.
Oradell, New Jersey

Burns and Roe is an independent consulting engineering organization established in 1932 devoted to the practice of engineering and design, construction, and related services for major utility, industrial, chemical and research projects both in domestic and international areas.

Testimony of

HARRY E. LUNT, P.E.
Corporate Consulting Engineer
Burns and Roe Enterprises, Inc.
and
Chairman
ASTM Committee A-1 on Steel, Stainless Steel and Related Alloys

UNITED STATES PARTICIPATION IN THE DEVELOPMENT OF INTERNATIONAL STANDARDS FOR STEEL

I wish to thank the Committee for this opportunity to express my concerns about the funding of United States participation in the development of international standards.

Need for Funds

The ASTM committee that I chair, Committee A-1 on Steel, Stainless Steel and Related Alloys, is running out of money for administering our Subcommittee 95 which serves as the U.S. National Committee for International Standardization of Steel. Subcommittee 95 performs the tasks associated with representing the United States in Technical Committee 17 (TC 17) of the International Standardization Organization (ISO). If the USA is to continue to make its presence known in ISO/TC 17, we in ASTM Committee A-1 must find additional sources of funds.

Importance of International Standards

I cannot overemphasize the importance of international standards. Standards are the wheels of industry, and international standards facilitate international trade.

Standards contain the rules that define things that are bought and sold. Standards for steel define steel products, whether forgings, castings, rolled plate, sheet, strip, structural shapes, or whatever. They fix the grades by setting limits on the chemical compositions, strengths and other properties. They enumerate and describe the tests and inspections required and criteria for acceptance and rejection.

Each country would like the rules for products sold internationally to be slanted towards its own domestic technology, just as we in the United States want international standards to be compatible with our facilities and practices. Certainly, we need assurance that the rules of international trade are not manipulated to exclude American industry.

United States Participation in ISO Technical Committee 17 on Steel

ASTM Committee A-1 was requested by the American National Standards Institute (ANSI) to serve as the Technical Advisory Group (TAG) for Technical Committee 17 on Steel (TC 17) of the International Standardization Organization (ISO). ANSI, the USA member to ISO, not being expert in everything of interest to ISO, looks to American technical and professional societies for guidance in the form of Technical Advisory Groups (TAGs). Hence, ANSI's request for our help.

U.S.Participation in ISO Influences Euronorm Standards

By agreement among the member countries, the European Community will adopt Euronorm Standards as their national standards in 1992 replacing the existing national standards. This will have a profound effect on international trade.

Fortunately, many of the Euronorm standards are being copied from existing ISO standards, according to my information. Thus, the participation of my ASTM Committee A-1 in the preparation of ISO standards for steel is having a positive influence on European standards. The forthcoming European standards for steel will be compatible with American practices and capabilities, and this will make it easier for USA producers and users of steel to compete in international trade.

The History of Funding

In past years, the American Iron and Steel Institute (AISI), a trade association of steel companies, provided the funding for travel of U.S. delegates to ISO/TC 17 meetings, and the AISI also covered the costs associated with the operation of the Secretariat of the ISO Subcommittee on Sheet Steel (ISO/TC 17/SC 12), which is held by the United States. This Secretariat is of particular importance because sheet steel is by far the single largest tonnage product worldwide. The United States also holds the Secretariat of the ISO Subcommittee on Steel Castings (SC 11); the operation of this Secretariat continues to be funded by the Steel Founders' Society of America, another trade association.

Although funding by steel trade associations provides the needed money, it has a major drawback. It is not democratic. When AISI funds for ISO travel expenses were available, they could be used only by members of AISI; that is, only by producer representatives. Thus, participation was producer oriented. The Steel Founders' Society of America continues to impose similar restrictions on its funding.

In mid-1986 the AISI ceased funding ISO activities.

This loss of the steel industry's financial support was a great concern to us in ASTM. We feared that withdrawal of the United States from participation in the development of international standards for steel would seem to the rest of the world to mean that we don't think their ideas are important and that we don't need them. In addition, we felt that the loss of U.S. participation in the development of international standards would have an adverse effect on export performance. Certainly, success in promoting wider acceptance of standards based on American technology should affect trade favorably. Our expectations have been confirmed by the report, "A Review of U.S. Participation in International Standards Activities" by P.W. Cooke, NBSIR 88-3698 (PB88-164165) January 1988.

Therefore, my ASTM committee determined that we would have to raise the money ourselves. If we did not or if we were not successful, we would have to relinquish the important Secretariat of the sheet steel subcommittee and become a lower class non-voting member of ISO. We then defined our goals in a plan which we submitted for approval to the ASTM Board of Directors. The Board approved the plan.

Our initial soliciation of American industry was only moderately successful. For a while, it looked as though we would be able to continue our full membership but that we would have to give up the secretariat.

The Army to the Rescue

It may sound romantic if I were to say that the Army came to our rescue, but that is just what happened. People from the Materials Technology Laboratory in Watertown, Massachusetts, part of the U.S. Army Laboratory Command, have been long time participants in ASTM and Committee A-1 and in the activities of the Technical Advisory Group for ISO/TC 17. In A-1, their interest is to get agreement on modifications to certain ASTM standards so that they can be used for Department of Defense procurement in place of military standards. This effort has been very successful. Similarly, they are interested in our ISO activities because of the desirability of having ISO standards available for DoD procurement if they meet American needs.

The DoD support has kept our work in ISO going and has permitted us to continue the operation of the sheet steel secretariat. However, this support is not likely to be long lived because the Materials Technology Laboratory in Watertown is on the list of Army facilities to be closed. The closure of the Laboratory is likely to be the death knell of our DoD support.

As for our financial support from American industry, that has been small and is approaching the vanishing point. Among those companies willing to donate the time of experts to carry out the ISO work, most are unable to support the travel and other expenses involved.

Ironically, the amount of money needed is moderate, but a stable source of funding definitely is needed for the USA to continue to participate in the development of international standards in ISO.

USA Disadvantage

The United States has been at a distinct disadvantage in ISO because many employers, particularly user companies, have found it difficult to fund the expenses associated with ISO work. According to the P.W.Cooke report cited above, other countries do not have this problem. Many, including Japan, Mexico, Korea, Poland, Yugoslavia, and the USSR, fully finance their ISO participants. Canada and most countries in Western Europe and South America provide a portion of the financial support ranging from 15 to 90 percent.

Recommendation

Therefore, I recommend that THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY fund the USA participation in ISO. That would put the United States more nearly on equal footing with other countries. Funding by the United States should be in the form of a grant to ASTM, who has been delegated by ANSI to administer the USA participation in ISO.

Government funding would correct the present disadvantage of the United States and would permit the United States to be more aggressive in negotiations for secretariats.

If federal funds for the development of international standards are given to ASTM, we volunteer members of ASTM will be able to continue to participate as the technical experts advising ANSI on how to vote in ISO. We believe strongly that American participation in international standards writing should continue to be under the auspices of the consensus standards writing organizations, ASTM and ANSI, rather than a government agency or bureau.

I thank the Committee for its patience.

Mr. **Walgren**. Thank you very much, Mr. Lunt. Interesting points, and I look forward to knowing some more about that.

There are some more bells there, so let's just steam right on through the panel, and, Mr. Miller, you're up, and we've got—my guess is, we have maybe 12 minutes or so, and maybe we can do justice to this in that time; if not, we'll come back.

Mr. Miller.

Mr. **Miller**. I'll attempt to summarize.

My name is Michael J. Miller, and I'm executive director of the Association for the Advancement of Medical Instrumentation. With me today are people who assisted me with this testimony and who are willing to provide whatever assistance they can to the subcommittee because of their more than 20 years experience as experts in international standards. These people include the president of AAMI, Dennis R. Stupak; Robert Flink, cochairman of the AAMI Standards Board; Mort Levin, who is president elect of the organization and chairman of the International Standards Committee; and Elizabeth Bridgman, the assistant executive director.

I will attempt briefly today to give you our opinion about what we perceive Government's role to be and give you our experience in international standards and developing a program that we think will significantly enhance the position of our medical device industry in world trade.

To put my statement in perspective, the U.S. Department of Commerce estimates that the U.S. industry has a 63 percent share, $22 billion, of the total world market. We are pleased to say that the U.S. in the world market is expanding, and the U.S. balance of trade is also increasing. More importantly, we feel that medical technology is making a tremendous contribution to the quality of life in the United States and in the world.

About the role of Government, we think that the American National Standards Institute has and will continue to play a very important leadership role in making sure that the United States is effectively represented in international standards. I note in passing that the American National Standards Institute has already approached the subject of voting rights in ISO, a subject that was mentioned a little bit earlier.

We continue to support a very strong leadership role in the private sector by ANSI and also support a collaborative role between ANSI and the Federal Government, and in one of our appendices we suggest how this role might be carried out through some type of a private sector/governmental council, and I note that ANSI has a similar proposal.

We note in background documents to these hearings that foreign governments heavily subsidize standards efforts and question whether the U.S. can afford to continue to rely on international standards work funded solely through voluntary contributions. We have no evidence to date, at least in our area, that the voluntary system presents an obstacle, per se, to gaining adequate representation in international standards activities.

We believe that if we put together a program that we can sell to the industry, and we do not believe that significant Government funding will be necessary. Consequently, we do not come before this committee espousing Federal funding. We think that the Federal Government has other roles that are just as important. We think that the Government should educate the U.S. industry about the increasing importance of international standards. We support the concept, or at least the exploration of a concept, of competitive grants and contracts through a governmental/private sector council. We believe that such a council could also assure collaborative efforts between the private sector and Government and make sure that the United States speaks with one voice throughout the world, which we think is very essential to effective representation of U.S. interests in international markets.

We have found Government experts' participation in our international standards activities very helpful, and we hope that Government will continue to provide travel funding to technical experts in our areas of activities, particularly experts from the Food and Drug Administration.

We think the Government can play an essential role in assuring organizations such as AAMI access to international standards activities, specifically, as we mentioned earlier, voting privileges, procedures, and policies that don't discourage the participation of experts from the United States. Once again, we support ANSI and hope that there will be a collaborative effort developed between the Government and the private sector.

A brief note about voluntary medical device standards, and we think this is important. Most medical device standards in this country are voluntary. Both State and Federal Governments have elected not to adopt mandatory standards for some very good reasons. First of all, these standards provide a reasonable assurance that safety and performance, while at the same time they assure that the industry can continue to innovate and provide user flexibility. We believe that this is quite different from some of the standards around the world, such as European standards, which are often regulatory oriented and written by people with academic and regulatory backgrounds. As a result, the standards in Western Europe tend to be constrictive and rigid.

We think one of the most important points in our international standards programs is that we can make technical experts available on the right committees, at the right place, and at the right time, and we think this is a very important role for the private sector. We have physicians who are working on international standards committees who have been as influential as anyone in making sure that the U.S. technology is reflected in international standards, and, as I will point out later, we have been most successful in reflecting U.S. technology in international standards.

Briefly, what is the AAMI program? First of all, the AAMI program is based on experience and success. Our standards have been either deferred to or used by both national and international bodies. The FDA defers to a number of our standards and uses our standards as regulatory mechanisms. Japan and the United Nations use our standards. Consequently, we operate from a base of good experience, confidence, and trust.

Our program basically revolves around gaining influence through the administrative mechanisms of organizations such as ISO and IEC. We believe that if we can operate effectively in ISO and IEC and promote the concept of world standards, we can avoid regional standards or EC standards developed in organizations where the United States has little or no influence.

Once again, we think placing U.S. experts with practical working knowledge of medical devices is the best way for the United States to maintain a strong competitive position in the world because the rest of the world is very interested and needs U.S. knowledge and experience in the area of medical devices.

We believe we have created a program that is a win/win situation for the United States and Western Europe and the rest of the world. They need our standards to expedite the integration of Western Europe, and we're willing to provide the technology information that we have available to them because it's in our interest to do that as well as theirs.

We have garnered the support of our membership, Government, and the industry, and, as a result of this, they are willing to fund our program and to fund our experts to attend these meetings in Western Europe and the rest of the world.

We note that this is not just an issue pertaining to Western Europe. We believe that good ISO and IEC standards are a way of translating U.S. technology to all countries of the world. We note in passing that the Soviet Union, Japan, China, and other Far East countries participate in international standards activities, and we think this has great significance.

While the funding we have made available is only adequate for our pilot program, we are convinced that if we can continue to convince Government agencies and our membership in industry that our program will be successful, that we can gain additional funding.

In conclusion, over a very short period of time AAMI and the U.S. medical device industry have mobilized a cooperative effort and, working closely with health care providers, Government, academia, and other institutions, have developed a strategy that will maintain a strong U.S. position in international trade and will also likely be supported by interests in Western Europe.

We strongly support the concept of a collaborative arrangement between ANSI and the Government by which each can bring its strength and resources to bear to international trade issues while AAMI and similar organizations concentrate their efforts where they will be most effective.

We look forward to working with the Government and the private sector and private sector organizations such as ANSI to complete our program and for the realization of the transfer of U.S. technology through standards internationally to assure the U.S. its rightful competitive position in the world.

We appreciate the opportunity to appear today here and share our information with you. Thank you.

[The prepared statement of Mr. Miller follows:]

Testimony Before the

U.S. House of Representatives
Committee on Science, Space and Technology
Subcommittee on Science, Research and Technology

Hearing on

International Standardization: The Federal Role

July 25, 1989

Statement of

Michael J. Miller, J.D.
Executive Director

on behalf of

The Association for the Advancement of Medical Instrumentation
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Statement by the
Association for the Advancement of Medical Instrumentation
before the
U.S. House Committee on Science, Space and Technology
Subcommittee on Science, Research and Technology
July 25, 1989

My name is Michael J. Miller and I am Executive Director of the Association for the Advancement of Medical Instrumentation. AAMI, as it is called, is a nonprofit membership association of 5,000 health care professionals from industry, health care facilities, academia, research and government, who are committed to advancing medical technology and patient care. We do this in a variety of ways, including certification of biomedical engineering personnel, education, technical publications, and, the focus of my testimony today, the development of standards for medical devices.

Accompanying me are AAMI President Dennis R. Stupak, President of Renshaw Heilman & Associates, Inc., Robert Flink, Cochairman of the AAMI Standards Board and Director of International Regulatory Affairs at Medtronic, Inc., Mort Levin, Chairman of the AAMI International Standards Committee and Quality and Regulatory Affairs Consultant to Hewlett-Packard, and Elizabeth Bridgman, AAMI Assistant Executive Director. Messrs. Flink and Levin and Ms. Bridgman are experts in aspects of international standards and, with prior consultation with Subcommittee staff, I may call upon them in areas where they may assist the committee.

On behalf of AAMI, I am pleased to be able to testify before this Subcommittee and share our experience with standards systems within and outside the U.S., how they relate to one another, what our industry has accomplished in developing and implementing an international standards program, and how government may be able to most effectively assist efforts such as ours.

According to recent Department of Commerce estimates, the U.S. industry has a 63 percent share, or $22 billion, of the total world market for medical devices, representing $36.1 billion in sales. Forty percent of all U.S. exports were purchased by countries in the European Community, and worldwide, U.S. exports versus imports of medical devices represent a favorable trade balance of over $1 billion.

We believe that having a strong and effective voice in international standards will help to assure that U.S. industry maintains its competitive position in Western Europe and the rest of the world, and that it is essential for any industry -- and government --with overseas goals to consider and incorporate international standards into its strategy and program. The AAMI program was built on those beliefs, and is designed to secure and to strengthen the U.S. medical device industry's place in world trade.

The Role of Industry and Government in International Standards

You have raised a number of questions pertaining to the role of industry and government in international standards. As a developer of national and international standards for over 20 years, AAMI believes that there are important roles to play for both the public and private sectors and that the strength of the U.S. system is this shared responsibility.

Our experience has been that the management and technical knowledge that is necessary for international standards activity exists within the voluntary sector, that the representation of national interests by objective U.S. technical experts is conducive to our acceptance in forums outside the U.S., and that the private sector wants to assume a role in international standards development and is willing to bear its portion of the cost.

An important link between the many industries and voluntary organizations that are involved in national and international standards is the American National Standards Institute, and it, too, has an integral role to play. ANSI has performed a valuable service to AAMI by assisting our efforts to gain effective U.S. representation in several international medical device standards committees. The Institute has also been sensitive to the financial concerns of our members, permitting us to channel limited resources in a way that is most economical for AAMI.

You rightly point out that many foreign governments heavily subsidize standards efforts, and question whether the U.S. can afford to continue to rely on international standards work funded solely through voluntary contributions. We note that foreign industries also heavily subsidize these efforts.

To date, we have no evidence that the voluntary system presents an obstacle, per se, to our gaining adequate representation in international standardization activities. Certainly, funding from the government or other sources would assist AAMI's efforts, but there are other areas where government resources can be even more effective and the assistance that we seek is not primarily that of federal financing. If the U.S. is to be successful in international standards, thereby enhancing industry's ability to compete in overseas markets, it is now most important that the federal government lend its considerable influence and political support as well.

An appropriate role for the U.S. government, and, in fact, one that only the government can assume, is to integrate support of voluntary international standards efforts into its formal trade policy(ies) with other countries. Additionally, we would welcome and recommend that the U.S. Congress take steps to encourage and facilitate the support we have received from the FDA's Center for Devices and Radiological Health, U.S. Food and Drug Administration of the Department of Health and Human Services, and other agencies. We hope that the government engineering experts will receive increased support from their agencies and their directors so that they may increase the time they spend on AAMI standards development and travel to allow their participation in international technical committee standards work.

We look to the government for such assistance and for a partnership between government and the voluntary sector. We would be opposed to government control or direction over the voluntary system, which, we feel, would be an impediment to AAMI and ANSI's efforts. ANSI is in a singular position to facilitate and coordinate the efforts of diverse interests and to represent the U.S. on issues that cut across all standards activity before international standards organizations. Organizations such as AAMI need and want access at the committee level. Having the right expert at the lowest level, that is the international working group level, can often be the most effective approach to international standards. Combined with those of government, ANSI's activities will, in turn, assure that international standards programs of the voluntary sector, such as the one AAMI has recently adopted, achieve their goals.

We think that it is very important for the government and private sector to speak with one unified voice, and have submitted to the Subcommittee staff specific program proposals (Appendix A) through which government could provide guidance and assistance to the private sector. While these proposals need further thought and development, they may be useful background to the Subcommittee. We would be pleased to discuss the proposals in more detail during the question and answer period, or later with members or Subcommittee staff.

AAMI International Standards Program - Background

To help place our international standards program in context, I will first very briefly describe U.S. standards and point out some differences between U.S. and European standards, at least as they pertain to our industry.

The requirements set forth in AAMI standards are developed by committees comprised of technical experts, including those who manufacture, those who use, and those who engage in academic research or who regulate medical devices. Final standards must be agreed upon by an overwhelming majority of these broad-based committees in adherence to strict, documented consensus procedures. European standards are developed in a similar manner, but often have much less input from device experts who have experience with daily application of the device. Rather, Europe's academic and government experts, and pure researchers are more likely to be involved.

Standards in the U.S. provide a measured response to the need for acceptable safety and performance specifications. They are intended to help producers and designers of medical equipment, and are careful not to restrict innovation and technological advances. This is particularly important with regard to the medical device industry, as our industry deals with life-saving equipment and our advances have the potential to improve much more than the bottom line of industry. Doubtless, this is one of the reasons that the U.S. is a leading exporter of medical devices, and has a positive trade balance in this area. European standards, often regulatory-oriented and written by persons with academic and regulatory background, tend to be much more constrictive and rigid.

Medical device standards serve a variety of functions and can be divided into two basic categories -- product standards and, secondly, recommended practices. In the context of international standards, our industry's primary concern is product standards.

The requirements and related tests included in product standards are designed to assure that patients who rely on medical equipment receive safe, efficacious care to the extent that equipment design or performance decides that. User safety is also addressed. For example, cardiac defibrillators are designed to intentionally shock heart attack victims through accurate delivery of a specified amount of energy, and not to accidentally electrocute the doctor who is defibrillating the patient.

These standards are used in the design and manufacturing of equipment, and by device owners to guide purchase decisions or assess equipment already on-site. Unless adopted by a U.S. federal or other governmental agency, adherence in America to the standards is voluntary, although the marketplace is an effective enforcer of compliance. The advantage of this voluntary system is that it leaves latitude for technological advancements while still maintaining a high degree of patient and user safety.

Of course, no matter how well it is constructed, a medical device is only as good as the person responsible for its application to real-life medical situations, and must also be kept in good working order through preventive maintenance. We therefore develop U.S. standards that are specifically directed to health care providers and device technicians. These recommended practices cover the use and maintenance of medical devices for the best possible patient care.

Lastly, if applicable, AAMI standards also address environmental safety issues. For instance, one form of sterilization performed in hospitals uses a highly effective but potentially hazardous gas -- ethylene oxide, and environmental safety issues apply to both the product standards and user-oriented standards.

There are two reasons why a standard on a specific piece of eq may not exist. One is finite resources. Standards development is labor-intensive, protracted and expensive undertaking for both the spo organization and the technical experts who volunteer their time anc costs. Thus, priorities must be established. Also, on rare occasions, a is so new, or advances in technology are so rapid, that the experts c that there is insufficient or inconclusive scientific data upon which minimum requirements.

International standards program

AAMI's corporate members -- medical device manufa companies -- made it clear in 1988 that the integration of the European countries, representing a market of 320 million plus con could be a major opportunity for U.S. industry to expand its sales, but could be a formidable challenge.

Unlike the U.S. voluntary system, under the European Community, or "EC" system, standards will become regulations in Western Europe and thereby have an enormous influence on the competitive position of countries outside the EC, including the U.S.

We discovered through written and telephone surveys of our industry members - and numerous nonmembers - that a primary area of concern was that the standards to be adopted by the EC could be developed in organizations such as CEN -- the European Committee for Standardization -- and its electrically-oriented sister organization, CENELEC. This concern stems from the very limited participation available to U.S. industry in CEN/CENELEC, as indicated to us by our members and later confirmed through direct inquiries to those bodies.

Thus, future standards that are developed in CEN and CENELEC and are given EC regulatory power are viewed as most likely to have an adverse effect on U.S. companies. The approach that AAMI has adopted will provide some avenues of participation in CEN and CENELEC, but without these approaches the U.S. industry would have no access to their standards development.

On the other hand, the U.S. is a member with substantial influence in two international standards organizations -- the International Organization for Standardization, ISO, and the International Electrotechnical Commission, IEC. Though based in Europe, ISO and IEC represent and have members from around the world.

Representatives of the EC and CEN/CENELEC have publicly announced that they will defer to ISO/IEC standards if available and if the standards meet their needs. Otherwise, CEN and CENELEC will write standards, with the financial support of the European Community, to enforce EC directives. Similar to the U.S., ISO and IEC do not have standards on everything owing to finite resources or lack of data. I should add that CEN and CENELEC are not likely to initiate new standards work if it is anticipated that the required standard will soon be available through ISO or IEC.

Manufacturing one product that has to meet the combined requirements of two different standards can increase production costs. If the standards are too disparate and have conflicting requirements, it is even more expensive and can sometimes force the manufacturer to either design and produce two variations of the same piece of equipment, or choose between markets. The U.S. companies could also be placed at a competitive disadvantage if EC standards set requirements reflecting manufacturing practices that our technical experts and regulators believe to be overly restrictive and are therefore not required nor commonly followed in the U.S.

Any such standards adopted by the EC, and replacing those of each EC member country, may adversely impact on U.S. exports to individual European countries that presently follow practices similar to the U.S., and some of which represent significant markets by themselves. Viewed collectively, the difficulty of marketing products in the EC at competitive prices, under standards that are very different from U.S. standards, is compounded.

The AAMI Strategy

A Task Force appointed by the AAMI Board of Directors developed a strategy and outlined a program that would help AAMI's industry members compete internationally. This strategy is based on the assumption that the EC and other world governmental bodies will use and conform to international standards developed within IEC and ISO and also defer new work if needed standards are slated for or are being developed by ISO/IEC committees.

Our objective is to work with the EC by giving them the standards they need to accomplish the integration of Western Europe, but to develop these standards in a context that is in their interest as well as our own, namely through ISO and IEC. In fact, we have already received informal assurances that AAMI's standards and international involvement would be welcomed by Western European interests.

Our industry and our program look beyond Western Europe to all overseas markets, and again, ISO and IEC provides us with reasonable access to international standards in a world where the impact of national standards may soon be greatly diminished. The Soviet Union, Japan, China and other far east countries participate in international standards activities. Further, we see events in Western Europe as a catalyst for far-reaching, worldwide changes. As each country and economic bloc that buys or sells in the

European Community feels the impact, it will need to adjust. We believe the adjustments will be similar to what is taking place in the U.S. today.

Strategy Based on Success

In addition to the Task Force, we worked closely with other associations that represent our industry and with U.S. government agencies to refine the program recommendations before going to the AAMI Board of Directors. We were able to persuade industry, government, and the professions about our strategy because it is based on past experience and success. In May 1989, the AAMI Board approved the following strategy plan:

1. That AAMI initially assume a leadership position in international standards for electromedical devices and safety; sterilization technologies; cardiovascular implant devices; and biocompatibility and toxicity testing procedures. There are very few U.S. companies that will not be affected by at least one of these areas of standards.

The medical device areas we chose to concentrate on initially in terms of obtaining a leadership role are those where the U.S., through AAMI, has a reputation for contributing significant standards and committee expertise necessary for their development. For example, AAMI's experience as the secretariat administrator of an ISO subcommittee that is responsible for developing world standards for pacemakers and other medical devices has been most favorable. AAMI has taken its applicable domestic standards to the international subcommittee and convinced other countries that these documents are useful points of departure for world standards. As a result, much of the content of world standards for pacemakers, heart valves, oxygenators, dialysis equipment and vascular graft prostheses reflect AAMI's standards and U.S. technology.

Additionally, AAMI standards have been accepted and are used by national and international government agencies. The FDA, U.S. Health Care Financing Administration, Japan and the United Nation's International Atomic Energy Agency, to name a few, defer regulatory action based upon the existence of AAMI voluntary standards, adopt them as regulations, or incorporate them in government-sponsored user education programs. The FDA, for example, has deferred mandatory standards regulation of cardiac monitors because the AAMI voluntary standard provides adequate protection to the patient through the adherence of the U.S. industry and because voluntary standards are much less expensive and restrictive than regulatory standards.

2. That this leadership be asserted primarily by assuming, where possible, responsibility for the administrative "secretariats" for these international standards activities, both nationally and internationally (for example, U.S. technical advisory groups (TAGs), and international subcommittees and working groups for standards development).

The receptiveness of U.S. and international standards organizations to our administration of secretariats is based on our 20 years experience, in which we have demonstrated our competence and earned a reputation for effective technical committee administration; knowledge and ability to work within both the U.S. and international systems; and our substantial contacts, both nationally and internationally.

These contacts extend beyond what is necessary to put together a well-balanced standards development committee. For example, a representative of the Soviet Union government made a special point of inviting AAMI to discuss the "technology" of medical device standards development at a sterilization conference being held in Moscow this September. AAMI looks forward to such opportunities to educate other countries about standards development, assisting foreign governments and also enhancing U.S. interests, and I have most willingly agreed to give the presentation.

3. That this leadership role be funded primarily by AAMI membership dues and nonmember fees, but that outside funding be sought from nonmember corporations, government agencies, medical societies, and trade associations which will be affected by these international events as much as AAMI and its members.

The AAMI leadership believes that our program will serve many groups, not just our industry members, and to be successful, we need the full support of all who will be affected. The Task Force recognized that the expansion of these activities would generate little if any revenue and, in fact, might reduce AAMI's revenue from domestic standards as international standards take their place.

AAMI standards reflect the combined expertise of industry, government, and the medical community as represented by individuals who are widely-recognized as top experts in their fields. It is the latter's knowledge of real-life applications that make AAMI standards among the most well-respected in the world. Many of them contribute not only their knowledge and time, but also support AAMI efforts through individual membership dues.

We have found that U.S. medical experts are well received at international committee meetings and have built travel sponsorship of individual technical experts into the budget. Reflecting that the initiation of the AAMI international standards program was primarily industry-driven, the budget and funding mechanism seeks industry support beyond AAMI membership.

Status Report

We have accomplished our initial objectives as outlined in the Board-approved strategy plan.

In June, the American National Standards Institute officially designated AAMI as the administrator of a proposed international technical committee on sterilization (subject to ISO approval of the committee and its U.S. administration; both are fully anticipated), and designated AAMI as the administrator of a U.S. Technical Advisory Group for the international committee on biological evaluation, ISO/TC 194.

Since then, the first meeting of ISO/TC 194 on biological evaluation was held in West Germany, and over a two-day period, the committee outlined the scope of its work and set up working groups. On July 13, the committee, which includes representation from nine Western European countries as well as Israel, Japan, East Germany and the U.S., by an overwhelming majority, designated the U.S. and AAMI as the convener of a working group to develop a world standard on the applicability of biological testing procedures for medical devices.

This is the working group that the U.S. TAG administered by AAMI identified in late June as the most significant to U.S. interests and where U.S. efforts should be concentrated. The vote was between the U.S. and one other country; a third country, West Germany, withdrew its request after the U.S.

made clear its strong interest and seriousness about expeditiously completing the work. By the outcome, we can only presume that views of the U.S. technological base and resources are quite favorable among TC 194 members.

Other progress we have made includes:

AAMI has begun discussion with the Health Industry Manufacturers Association, HIMA, about assuming responsibility for the TAG administrative functions now held by HIMA for a number of electromedical standards in IEC. HIMA is most willing for AAMI to assume this responsibility.

AAMI has initiated discussions with HIMA for a cooperative and coordinated effort to establish U.S. positions on international standards. AAMI has requested financial support from HIMA for these activities. A HIMA committee has initially reviewed this proposal and made the recommendations that (1) the funding be approved, (2) HIMA encourage its members to become members of AAMI, and (3) HIMA encourage its members to participate in and support AAMI's international standards program.

I am also pleased to announce that the U.S. Food and Drug Administration has stated that it will financially support the expansion of the AAMI program.

Thus, our initial efforts to secure outside support and funding to complement membership funding has been successful.

We are very optimistic that, as a result of HIMA and FDA's support, AAMI can attract a significant number of new corporate members to help spread the costs of the international standards program over a larger base of members and possibly permit program expansion. There is much work to be accomplished in other areas that our initial program, which reflects important but, nevertheless, pilot projects, does not contemplate.

We emphasize that the initial funding seems adequate for what we plan to accomplish, but to maximize our influence and success will require an expansion of our efforts and entail increased costs. We are hopeful that as we move forward with the program, and evidence of our success in reflecting U.S. knowledge or technology in international standards grows, industry, government and professional participation and support will also continue to grow and allow us to expand our work.

Conclusions

Over a very short period of time, AAMI and the U.S. medical device industry mobilized a cooperative effort and, working closely with health care providers, government, academia and other institutions, developed a strategy that will maintain a strong U.S. position in international trade, and that is also likely to be supported by interests in Western Europe.

Western Europe is likely to support our efforts because, in effect, we are doing work they need to have done, and we can offer U.S. experts in areas where we have developed significant standards or the network of technical experts and other contacts to do so is already established.

We wish to clearly indicate that the assistance we can provide to Western Europe through standards activities is not the type that offers anyone "trade secrets". We are offering assistance in establishing basic safety, performance, and testing parameters that will benefit the world, without compromising industrial security.

In true standards vernacular, the "consensus of opinion" is that assisting Europe in this way is also in the best interests of the U.S., an opinion that is readily apparent by the support we have received from the U.S. medical device industry, health care professions, and many others.

Through a combined effort of specialized U.S. organizations and experts participating in technical international standards development committees, the liaison between ANSI and international organizations with similarly broad responsibilities, and U.S. government influence and support in its dealings with foreign governments, our multi-tier system allows adequate representation and provides unique opportunities as well.

We strongly support the concept of a collaborative arrangement between ANSI and the government by which each can bring its strengths and resources to bear on international trade issues, while AAMI and similar organizations concentrate their efforts where they will be most effective.

In particular, we acknowledge and express our appreciation to representatives of the Food and Drug Administration, the Health Industry Manufactures Association, and the American National Standards Institute who helped materially in making this program possible. We also thank this committee for hearing our statement, and hope that you agree with us that government support of the voluntary system, a proven system that has served the American public and industry well, should continue.

The programs we are putting in place today are instrumental to achieving access to international standards that will, in turn, influence important world markets. While we have much work yet to do in developing these standards, the AAMI international standards program holds much promise for favorably affecting the U.S. medical device industry, and at the same time, improving patient care around the world. Now, we look to government to work with us and the voluntary system and, together, devise ways to strengthen U.S. efforts and the ability of the U.S. to compete in world trade.

Thank you.

APPENDIX A

Association for the Advancement of Medical Instrumentation

Additional Information Pertaining to Issues Raised in the Subcommittee Charter Statement

1. How can the U.S. integrate standards assistance into U.S. policy?

Response: The U.S. government should support the objectives of ANSI; work closely with ANSI and other private-sector organizations; be vigilant about and discourage policies and procedures of countries that reduce U.S. access to the international standards development process; and encourage government technical experts to participate in the international activities of national organizations such as ANSI and AAMI. Our members believe that it is very important for government and the private sector to speak with one voice in international standards.

2. How were you able to develop and fund your program so quickly?

Response: It was of no little consequence that AAMI has considerable experience and success in translating its domestic standards (which are, historically, of significant domestic and international value to industry) to international standards. AAMI had credibility with and the confidence of all the key players in the U.S. and the rest of the world.

In short, we developed a good "product" at a reasonable price and marketed it effectively to industry, government, and the professions. This is not the type of program you can construct overnight; many years of work provided the foundation of credibility and trust.

Our experience and our program, once again, are based on placing experts in medical devices and standards at the working group level where they can be most effective. This means that U.S. leadership, knowledge and experience are being focused in a specific area of technology in the most effective manner. This results in effective utilization of limited resources and increases the probability of industry financial support.

Our program recognizes that experts must be knowledgeable in two areas during the standards development process: knowledgeable about medical devices and knowledgeable about standards development.

We would be remiss if we did not acknowledge the contribution, support and foresight of leaders in industry, HIMA, ANSI, and the FDA.

3. What does your experience indicate would be the appropriate role for government in the context of your program and Saudi standards development?

Response: We have found that a very specific focus of technical and standards leadership is most effective. The private sector can provide technical experts in specific areas of technology and in standards. Government and ANSI should provide the private sector experts access to the standards process internationally and, if appropriate, within specific countries.

Our experience indicates to us that providing guidance and assistance to Saudi Arabia may be more effective if it is well-defined and focussed. We wonder if the Dymally program could have been more effective by organizing appropriate industry and standards organizations, possibly through ANSI, to provide funding and experts in their own product areas. It seems to us that regardless of whether you are talking about international standards or a single country's standards, the best role for government and ANSI is to provide access to the standards process for experts in specific areas of technology and standards. General experts are best utilized to coordinate the specific expertise needed.

The private sector is in the best position to determine if a project makes sense and, therefore, to direct selection and funding of experts. This is the type of business decision that is made every day within the private sector. We find it hard to believe that the major industries of the country would be unwilling to fund any standards activity if the benefits are effectively articulated and the costs are reasonable.

Quite frankly, we would welcome government financial assistance, but are concerned about how this can be provided without government controlling or directing the voluntary process. Perhaps there is some way that government can provide funding to ANSI and organizations like AAMI, based on the obvious success and impact of programs. It is conceivable that a government program could be devised by which organizations like AAMI could apply for competitive grants or contracts for work, similar to the way scientists apply for grants and contracts at the National Institutes of Health. Such a program would, in some respects, put the U.S. on an equal footing with the EC countries, since the Commission of the EC provides funding for development of European standards in strategic areas of technology. We believe that the guidelines would have to be very specific or public funds could be poorly directed.

With respect to guidance on these types of grants and contracts, we also draw the Subcommittee's attention to the Food and Drug Administration's approach, which Congress devised. The FDA approach, which utilizes the private sector to provide technical assistance to government in the context of regulating medical devices, draws upon the private sector in forming its expert advisory panels. Expenses of these advisory panels are paid by FDA so that the FDA may gain expert advice on medical devices in complex areas. ANSI and government should consider a similar approach to create advisory panels to assure representation in important areas of international standards development. These advisory panels could provide guidance on areas where contracts and grants should be provided to private sector organizations that are developing or have programs such as AAMI's. These experts could act in a number of advisory capacities to assure that government and the private sector, acting in concert, were coordinating their resources effectively and appropriately.

Another approach to consider is for government, through grants and contracts, to encourage the formation of coalitions within specific industries to identify and fund experts' participation in strategic international standards activities. Government could operate this program through ANSI. We understand that specific U.S. industries have already begun to implement this strategy.

4. Do you have an opinion about standards assistance to developing countries?

Response: This is an area of policy that we are not as qualified to comment on. We will say, however, that this concept requires careful evaluation in terms of cost and priority. We wonder if other priorities are not more important, such as securing access to the process by which EC standards will be written and making certain that good standards are available in ISO and IEC.

It may be more effective to encourage developing countries to adopt IEC and ISO standards developed with strong U.S. participation than to fragment limited resources in an effort to provide experts in all developing countries.

Michael J. Miller, J.D.

Biographical Sketch

Michael J. Miller, J.D., is the Executive Director of the Association for the Advancement of Medical Instrumentation (AAMI), a position he has held since coming to the association. During his 20 years as AAMI's chief staff officer, Mr. Miller has managed or supervised a program for development of medical device standards that are internationally accepted by governments, industry, the health care professions and academic and health care facilities, in addition to overseeing operation of the association and its other programs.

Mr. Miller graduated from George Washington University Law School in 1965. He was employed in management positions for the American Association for Retired Persons and American Institute for CPAs prior to joining AAMI in 1969.

Mr. Walgren. Well, let me thank you very much for that statement, and, logistically, I've got to respond to that vote, and it comes right at the point where a person close to my heart, at least from Pittsburgh, is about to testify. But I'm pleased that Mr. Browder was able to join us and give you the right amount of time to present your statement, Mr. Weser. I apologize for having to leave.

Let me ask just one question of Mr. Miller.

You don't support funding, Government funding, for the standards program, and yet Mr. Lunt says that at least certainly in that area that the private sector funding is approaching the vanishing point. Is there some kind of reconciliation of those two views that you'd like to suggest?

Mr. Miller. Well, I guess the question I have in my mind is, why is the industry not funding the activities? We found no difficulty in going to our industry and, based on our record, of saying that we think that we can provide a significant influence on international standards, and, based on our record and our program, not only corporations but trade organizations and, I might mention in passing, the FDA have agreed that our program makes sense to them, that it's a good program, they're willing to fund it.

I can only share our experience with you. I'm not sure that I can tell you why other industries might not be able to provide the support that is needed in other areas.

Mr. Walgren. Thank you very much.

I leave you in good hands, Mr. Weser.

Mr. Browder [presiding]. Our next witness is Mr. Raymond Weser, director of Westinghouse Corporation.

Mr. Weser.

Mr. Weser. Thank you, Mr. Chairman.

First of all, I'd like to thank you for inviting us to the hearing of the international standards and the role that the Federal Government plays in this process. First of all, a little bit on my background. I'm from Westinghouse Electric Corporation. I'm director of strategic resources of Europe, Africa, Middle East. What that means is, I'm responsible for developing strategic plans, developing new businesses, acquisitions, mergers, and specifically in this process in these times to emphasize 1992. I'm a graduate engineer and have been with Westinghouse over 30 years in various positions, mostly management, and in many cases general management and other functional areas.

Most recently—and, by the way, most of these functions were international. Most recently, I have lived in Saudi Arabia, and I'd like to talk about that in detail a little bit later.

I'd like to address the need for greater U.S. participation in standards, financially and otherwise. I'm talking U.S. Government involvement. It takes a team effort to do the job. The European Community has an ambitious program to reduce the current multiple standards for each of the products that they have, and that's a good thing in some respects but dangerous in others. They're trying to harmonize, and they're looking for mutual recognition of standards between countries.

The U.S. Government in this case and private industry has been attempting to influence these standards, and I think they have been doing a great job, but there needs to be more work done.

I want to mention that all the people on the panel before me today, we are very supportive of all those, we're members of many of those organizations, but we support them all, and that's all I'm going to say at this time about Europe or other areas. I'd like to concentrate today on Saudi Arabia.

The Saudi Arabia situation is that the U.S., and specifically corporations that participate in Saudi Arabia and the Arabian Peninsula, have a unique opportunity, and, by the way, this includes the Arabian Peninsula and the Gulf Council or corporate councils. So that's quite a bit of business, and they pay cash.

SASO, which, by the way, stands for Saudi Arabian Standards Organization, requests and received outside standards assistance from anybody that could give it to them, and they are very open about that, paying some of the expenses. Let me just list a few: Finland, Germany, Great Britain, India, Netherlands, New Zealand, and Singapore, among others. They have people supported by their government in there every day working to set standards; Japan also. Japan has had from six to nine people working at one given time and over a long period of years. The result: SASO has written approximately 600 product standards, mostly being noncompatible to the U.S. products.

I think I don't have to go into the definition of why that is happening; it's a nontariff barrier approach. Each country in Europe—and, by the way, you'll notice the European countries mentioned as well as Asians—those countries not only do that in their own nationalistic areas, but they are doing that any place else in the world that they feel they can get a competitive advantage.

Let me give you some examples of what has happened. Back in 1979, '80, '81, distribution transformers in Saudi Arabia were specified almost exclusively American specification, ANSI/NIMA, as a matter of fact. SASO standards were written, and IEC became the standard. Corporations like ourselves supplied approximately $12 million a year of just that one single product line, head-mounted distribution transformer, to a point now where we obtain none of those things.

The U.S. electrical companies supplied large power transformers all during the seventies. It was pretty exclusive to the American product line. Today, IEC standards, no participation.

Efforts have been made to eliminate appliances, U.S. appliances, by setting certain standards from other parts of the world. By the way, we got out of the business in 1974, but while I was in Saudi Arabia working with the Government, with the embassy, with SASO directly, my people called me in to say, "Hey, GE has a problem; they can't get $5 million of refrigerators in," and you heard of some of that this morning when Congressman Dymally talked about the cord. Other things with appliances is electrical standards and safety margins and so forth. I won't go into details, but the point being, we were being locked out of the marketplace.

U.S. share of Saudi imports has dropped from 40 percent in 1980 to 18 percent in 1987. Now I'm not indicating that was all due to standards, but a good portion of that was according to standards.

Failure to take advantage of the Saudi invitation to join in the standard exercise that they asked us to help them with and, by the way, a preference for our American products—I think you've heard that all day today, and I concur—this is putting the U.S. at a major disadvantage in a key market area. Asia and European countries recognize this opportunity, have done so, and they are taking advantage of it.

Let me make two key points of why I support Government teamwork with private industry. Number one, the number of business segments in Saudi Arabia—and let's stay on that specifically—are multiple, many—agriculture, electrical, chemical, petroleum—and you could go on and on and on. That's what I mean by market and business segments. Within each one of those, there are hundreds of various specifications.

For each size, shape, there's different codes, and the problem is, you say, "Why don't you have industry handle that?" Because, first of all, not all industries are in Saudi Arabia, and they will never have an opportunity to get there from the United States for export or anything else while there is somebody inside making sure there is a nontariff barrier called standards to prevent that product, whether it's Clorox, whether it's Honeywell products, I don't care whose it is, there's somebody in there trying to fight you. But again I come back. A key point: I think that's a team effort.

Let's talk about relationship, my second point. The second point is, it's a government you are doing business with, it's ministers, ministries, and councils. Governments like to work with governments. They look at industry, as sometimes they do in the United States, with a jaundiced eye. What I'm saying again, the combination of the two gives us power and strength to go get American standards and American products for what we are all looking for, success in terms of marketing our products overseas.

What is needed is an adequately funded and staffed through the Department of Commerce to provide U.S. specialists to these countries who request, first of all, the assistance of it, which opens the door to us, and other countries that are looking to such standards.

American industry welcomes the interest of this committee. It's important, it's a very important subject. I strongly recommend that Congress provide adequate funding to the Department of Commerce so that the U.S. Government, working with industry, can respond effectively to the opportunities such as has been afforded to us in Saudi Arabia and any other country that fits that mold. We are very supportive of the Dymally bill, 2468.

Thank you.

[The prepared statement of Mr. Weser follows:]

Prepared Statement of Raymond Weser
Director, Strategic Resources, Europe, Africa
and the Middle East
Westinghouse Electric Corporation
Before the
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C.

July 25, 1989

INTRODUCTION

Good Morning Ladies and Gentlemen.

My name is Raymond Weser and I am Director of Strategic Resources for Europe, Africa and the Middle East for the Westinghouse Electric Corporation. I thank you for this opportunity to give you our views.

I am a graduate engineer with over 30 years experience in marketing and general management positions at Westinghouse, including five years as President of Westinghouse Saudi Arabia. I have dealt extensively with standards issues during my career at Westinghouse.

Given the above experience and knowledge in the area of international standards, I would like to discuss some issues which are of concern to Westinghouse and to the U.S. private sector in general.

I am here today, Mr. Chairman, to address the need for more vigorous participation of the U.S. Government in the important activity of international standard-setting. I will address the current state of our standards relationship with the European Community, but I wish to put major emphasis on the growing interest of many countries, including developing countries, to develop their own product standards and testing/certification procedures.

STANDARD-SETTING IN THE EC - A SPECIAL SITUATION

In my view, the situation in Europe is a special one. I believe that it must be dealt with in a different way than our standards relationship with Saudi Arabia, for example, and other non-European countries which seek to develop a set of standards.

- The EC Single Market Program (EC 1992) has developed a special approach to the daunting task of transforming thousands of privately-formulated standards in each of the 12 member states into EC-wide standards. The principle of mutual recognition of standards not involving health or safety will greatly speed the task. US industry was initially apprehensive that the EC, if left to its own devices, would seek to adopt standards which would be incompatible with US standards, thereby locking us out of the market.

o Thanks to the vigilance of US Government agencies, this concern has diminished. US firms will, as a result of Secretary Mosbacher's recent negotiations with the EC and the European standards bodies (The European Committee for Standardization - CEN, and the European Committee for Electrotechnical Standardization - CENELEC) have a chance to make their views known before new standards are adopted.

- Members of the American National Standards Institute (ANSI) will get advance warning from CEN/CENELEC of those standards for which drafts will be solicited.

- ANSI members will receive the draft standards at the same time as European firms.

- ANSI members will have the opportunity to comment on the draft standards through technical working groups set up under the auspices of the world standards bodies (International Standards Organization - ISO and International Electrotechnical Commission - IEC). Where possible, CEN and CENELEC have agreed to use ISO/IEC standards (where they exist) as a starting point in order to provide the most universal standards.

- At present, ANSI members are not permitted to participate in CEN/CENELEC meetings, even as observers. ANSI, through its new European office, is seeking to obtain observer status.

- Another unresolved area of concern is that of testing and certification. The EC Commission will shortly release a proposed directive which will establish the basis for recognition of non-EC testing and certification bodies.

Assuming that US firms are not allowed to participate directly in CEN/CENELEC standards-setting meetings, the following implications must be faced by Westinghouse and other firms interested in the European market.

- Since many of the EC standards which result will be identical to ISO/IEC standards, US firms can make a greater effort to produce in their US plants items which conform to those standards.
- In the case of those products for which there is no international standard and for which an EC standard (such as the existing DIN standard, for example), is adopted, US firms may find it prudent to establish production facilities in Europe.

To sum up the situation in Europe, US firms will have an input in the process, but probably only indirectly through ISO/IEC. Since it is very unlikely that the EC will choose to adopt many US standards over European standards in cases where no international standard exists, US firms will have to consider producing to non-US standards in order to maintain or increase sales in Europe. We are very pleased with the efforts the US

Government has been making to represent the interests of US firms in the standard-setting process. We remain concerned that the outcome of the testing/certification exercise will determine at the end of the day how open the EC market really is.

THE GATT STANDARDS CODE

Before describing the situation in Saudi Arabia and the developing world, a word about US participation in the General Agreement on Trade and Tariffs (GATT) Uruguay Round negotiating group which deals with the Standards Code. US industry appreciates the opportunity to provide, through the Industry Functional Advisory Committee (IFAC), views on ways in which the Standards Code could be strengthened. We support the US initiatives to increase membership in the Code and to improve the provisions of the code dealing with testing/certification, transparency of procedures, and the inclusion of processes and production methods. We consider the efforts being made by the US Government in the Uruguay Round to be an indispensable part of the process of reducing international standards-related trade barriers.

THE SAUDI ARABIAN PROGRAM

Turning to the Middle East, we have a special opportunity with which I am personally familiar, having chaired a Committee on the subject of standards for the American Businessmen's Group in Saudi Arabia for two years.

The special opportunity was provided by Congressman Dymally, whose amendment to the Authorization Act for the National Institute of Standards and Technology (NIST) for FY 1989, directed the Commerce Department, through the Director of NIST, to establish a privately funded program to assist other countries in the development of domestic standards that are compatible with those used in the United States. This provision was intended to provide for US participation in a program of the Saudi Arabian Standards Organization (S.A.S.O.) to develop a standards code which will affect over 42,000 products being imported into Saudi Arabia and the five neighboring states of Kuwait, Bahrain, Oman, Qatar and the United Arab Emirates. These countries have constituted an important market for US goods and services totaling over $80 billion in the past decade. In 1988, US merchandise exports to the region were $5.7 billion, including $3.8 billion to Saudi Arabia alone. These exports generated more than 170,000 jobs in the US according to a US Government formula which equates creation of 30,000 US jobs for every $1 billion in exports.

We are, however, in danger of losing much of the market and the jobs and export earnings so vital to our economy, if we allow the market to erode by the gradual adoption of product standards which favor European and Far Eastern products over those produced in this country.

THE NEED FOR A COORDINATED INDUSTRY - GOVERNMENT RESPONSE

When the Saudi Standards Organization was established in the 1970's, the Saudi Government invited its major trading partners to support this effort by providing specialists to give expert advice in developing product standards. Japan, Germany, Great Britain, France, India, the Netherlands and even New Zealand, Finland and Singapore have sent specialists. The United States thus far has neglected this opportunity, at least to defend if not to advance our interests.

Congressman Dymally's latest initiative (H.R. 2468), providing for US Government sponsorship for an American specialist to be funded by American firms engaged in commerce with Saudi Arabia and the Gulf, was welcomed by those American companies.

Working through an umbrella organization, the American/Saudi Roundtable, we have so far collected $185,000 from about fifty companies, and our President, Mr. Gilbert Dwyer, has indicated we expect soon to staff the position.

This is, however, only a stop-gap expedient to slow the erosion process while the Congress formulates measures to protect American industry's markets not only in the Middle East, but in the entire world.

Fortunately, this Committee, others in Congress, and Secretary Mosbacher at Commerce have focused on the importance of the subject.

Fortunately, too, there is still time to address the problem by adequately funding and staffing a program, within the Department of Commerce, to provide American specialists to work with foreign countries in setting standards compatible with those in general use in the United States. Harmonization will stimulate more US exports, create more jobs in the United States, generate more tax revenues and help reduce US trade and budget deficits.

American industry welcomes the interest of this Committee in a subject as vitally important to our broad national interests as this one. I strongly recommend that the Congress provide adequate funding for the general program described above so that the Department of Commerce, working with American industry, can respond effectively to opportunities such as that afforded in Saudi Arabia.

Mr. **Browder.** Thank you, Mr. Weser.

Mr. Weser, Mr. Miller, and Mr. Lunt, your testimony will be entered into the record, as you have been told.

I'd like to thank the other witnesses who have appeared before us today, and I can assure you that this committee will seriously consider that testimony as we try to address this problem.

Normally we have questions, and we do have questions we'd like to ask you, but since we have committed to vacate this room 14 minutes ago I think that what we will do is submit our questions to you in writing and ask for your response.

Without objection, this subcommittee hearing is adjourned.

[Whereupon, at 1:45 p.m., the subcommittee was adjourned.]

[Responses to questions for panel three follow:]

U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

SUITE 2321 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
(202) 225-6371

August 3, 1989

Mr. Harry Lunt
Corporation Consulting Engineer
Materials Engineering
Burns and Roe Enterprises
800 Kinderkamack Road
Oradell, New Jersey 07649

Dear Mr. Lunt:

Thank you for presenting testimony at the Science, Research and Technology Subcommittee's July 25th hearing on International Standards.

Unfortunately, due to time constraints, there was not sufficient time to engage in a discussion with your panel. Accordingly, we would very much appreciate it if you would respond to the enclosed questions, which will be incorporated into the hearing record.

Thank you again for your excellent testimony.

Sincerely,

Doug Walgren

DOUG WALGREN, Chairman
Subcommittee on Science,
Research and Technology

DW/cp
Attachment

QUESTIONS FOR HARRY LUNT AND MICHAEL MILLER

1. Do you feel that the interests of your industries are currently being adequately represented in ISO and IEC? How important and significant is such participation?

2. How do you explain the relative lack of funding of international standards activities by many U.S. industries as compared to their counterparts in Western Europe and Japan?

3. Can you give us some idea of the cost a company must bear to support its industry's participation in international standardization activities?

4. What kind of support have you received from U.S. standards organizations such as ANSI and ASTM in your efforts to raise money to fund U.S. participation in international standards organizations such as ISO?

What kind of government support have you received?

5. Since the United States has not taken action to provide for governmental representation in the international standards organizations (ISO and IEC), does the fact that many foreign standards organizations receive aid and official sanction from their governments constitute a significant advantage over the U.S. system?

6. In your opinion, what is the appropriate Federal role in facilitating U.S. participation in international standardization?

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Harry E. Lunt, P.E.
Corporate Consulting Engineer

September 25, 1989

Carol Pompliano
Committee on Science, Research
and Technology
Room 2319
Rayburn House Office Building
Washington, D. C. 20515

Dear Ms. Pompliano:

Congressman Doug Walgren's letter of August 3rd asked me to respond to six questions relative to my testimony of July 25th.

My response follows:

Q.1 Do I feel that the interests of the steel industry currently are being adequately represented in ISO? How important and significant is such participation?

A.1 In my opinion, the representation of American industry in the development of standards for steel in ISO is less than optimal because of the withdrawal of major steel producers and their trade association from ISO activities and because of the meager participation of user and general interest parties. This situation is important and significant because it impairs the ability of the U.S.A. delegation to ISO to secure secretariats for the U.S.A. and because it weakens the position of our delegation and its ability to influence the course of standards development.

Q.2 How do I explain the relative lack of funding of international standards activities by many U.S. industries as compared to their counterparts in Western Europe and Japan?

A.2 The lack of domestic steel industry funding reflects in part the profit pinch U.S. steel producers suffered in the mid-1980's and the greater competition among U.S. steel producers than among producers in Europe and Japan. It is influenced, too, by the contraction of the range of steel products produced by the major steel companies in the U.S.A. Many marginally profitable steel items no longer are produced by the major steel companies, and some are no longer produced in the U.S.A. Another contributing cause, in my opinion, is the current emphasis in American industry on short term profitability (this month's bottom line) as opposed to the long term viability of the enterprise. The culmination of this destructive trend is the precedence given to the development of the market value of the enterprise over the development of the business. Steel industry leaders in Europe and Japan, on the other hand, seem to face less severe domestic competition, and enjoy a greater export market than their counterparts in the U.S.A.

Q.3 Can you give us some idea of the cost a company must bear to support its industry's participation in ISO activities?

A.3 A company's cost to provide the services of a single qualified employee including travel expenses ranges from $4,000 to $8,000 per year.

Q.4 What kind of support have we received from U.S. standards organizations such as ANSI and ASTM in our efforts to raise money to fund U.S. participation in ISO? What kind of government support have we received?

A.4 Both ANSI and ASTM provide excellent organizational and administrative support. ASTM has been particularly helpful even though it cannot provide financial support. The ASTM Board of Directors has approved our plan to solicit funds from industry. ASTM holds and administers the funds and provides the accounting.

We are receiving funds for our ISO activities from the Department of Defense through the Materials Technology Laboratory in Watertown, Massachusetts, part of the U.S. Army Laboratory Command. The DoD funding is our principal financial support at present; our income from American industry is small and is approaching the vanishing point.

Q.5 Does the fact that many foreign standards organizations receive aid and official sanction from their governments constitute a significant advantage over the U.S. system?

A.5 Yes. The adequate and secure governmental funding enjoyed by some of the foreign delegations to ISO allows them to devote as much time and staff to the work as they find necessary, and gives them the means and confidence to be more aggressive in negotiations for additional secretariats.

Q.6 In my opinion, what is the appropriate Federal role in facilitating U.S. participation in international standardization?

A.6 In my opinion, the Federal role in facilitating U.S. participation in interational standardization is to supply the financial support to those Technical Advisory Groups (TAGs) that serve the U.S.A. member body to the international standards writing organization, ISO or IEC, when those TAGs cannot obtain private funding. For the area of interest of ASTM Committee A-1 on Steel, Stainless Steel and Related Alloys, which I chair, the Technical Advisory Groups are drawn from the volunteer members of the Committee; the funds are held and administered by the American Society for Testing and Materials (ASTM); the international organization is ISO; and the U.S.A. member body is the American National Standards Institute (ANSI).

I wish to thank the Subcommittee for this opportunity to amplify my concerns about the funding of United States participation in the development of international standards.

Very truly yours,

Harry E. Lunt

Harry E. Lunt, P.E.

HEL:cn

cc: The Honorable Doug Walgren

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Industry Consultant

September 28, 1989

Mr. Doug Walgren, Chairman
Subcommittee on Science, Research
and Technology
Committee on Science, Space, and
Technology
U. S. House of Representatives
Suite 2321 Rayburn House Office Building
Washington, DC 20515

Dear Mr. Walgren:

In response to your letter of August 3, enclosed are AAMI's responses to the questions you asked for concerning the Subcommittee's July 25 hearing on international standards.

Sincerely yours,

Michael J. Miller
Executive Director

MJM:sec

Enc.

Association for the Advancement of Medical Instrumentation
3330 Washington Boulevard, Suite 400, Arlington, VA 22201-4598
Phone: 703-525-4890 FAX: 703-276-0793
Twenty-Fifth Annual Meeting May 5-9, 1990 Anaheim, CA

RESPONSES TO QUESTIONS POSED BY THE SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE OF THE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

1. Do you feel that the interests of your industries are currently being adequately represented in ISO and IEC? How important and significant is such participation?

A. We feel that the interests of our industry are currently being adequately represented in ISO and IEC. The medical device industry is involved in almost all ISO and IEC activities that pertain to medical devices.

We feel, as outlined in our testimony, that the United States is taking an important leadership role in influencing and developing international standards for medical devices. As noted in our testimony, the FDA, Health Industry Manufacturers Association, and the Association for the Advancement of Medical Instrumentation, with industry and government financial support, have initiated an aggressive program to assume influential positions on strategic international standards committees in ISO and IEC.

2. How do you explain the relative lack of funding of international standards activities by many U.S. industries as compared to their counterparts in Western Europe and Japan?

A. We are not aware of any relative lack of funding of international standards activities by "many" U.S. industries as compared to their counterparts in Western Europe and Japan. Our experience is that there is adequate funding for international standards activities where this funding can produce an important influence and organizations have defined an appropriate role and persuaded the industry, government, and other organizations that this role can have significant influence in improving the industry's competitive position. Better information needs to be gathered concerning the perception that there is a relative lack of funding of international standards activities by many U.S. industries. This information should be gathered within the trade organizations for specific industries rather than second hand information received from individuals or committee participants. It may be that specific industries have determined that they have other priorities for allocating their resources or that in their particular industries international standards are not an impediment to the marketing of their products abroad.

3. Can you give us some idea of the cost a company must bear to support its industry's participation in international standardization activities?

A. The association has no concrete data on the cost a company must bear to support its industry's participation in international standardization activities. We also contacted the Health Industry Manufacturers Association and they indicated that they have no concrete data either.

4. What kind of support have you received from U.S. standards organizations such as ANSI and ASTM in your efforts to raise money to fund U.S. participation in international standards organizations such as ISO?

A. AAMI has received no financial support from organizations such as ANSI or ASTM in our efforts to raise money to fund U.S. participation in international standards but we neither requested such support or expected it. We felt that AAMI was in a position, working with HIMA and FDA, to generate financial support as effectively as anyone.

5. Since the United States has not taken action to provide for governmental representation in the international standards organizations (ISO and IEC), does the fact that many foreign standards organizations receive aid and official sanction from their governments constitute a significant advantage over the U.S. system?

A. We do not feel that the aid received by many foreign standards organizations and the official sanction from their governments constitutes a significant advantage over the U.S. system. In fact, we question whether this funding results in a number of disadvantages. For example, we find that experts subsidized from foreign standards organizations often do not have practical experience with medical devices. Experts funded from industry in the United States are generally much more knowledgeable about medical devices and medical device standards.

There are many persons involved with standards in the United States who feel that letting industry make decisions about what activities are funded and who should be funded results in pragmatic allocation of limited resources. The industry, its trade associations, and standards organizations are often in the best position to determine the most effective allocation of standards resources.

6. In your opinion, what is the appropriate Federal role in facilitating U.S. participation in international standardization?

A. As outlined in our testimony, we believe that there are a number of potential roles for the federal government in facilitating U.S. participation in international standardization. We believe that the federal government should (1) support ANSI and its objectives; (2) be vigilant about and oppose any policies and procedures of governments or international standards bodies that deny U.S. access to important standards processes; (3) develop a partnership with the private sector by which the federal government and the private sector's responsibilities in international standards can be carefully coordinated so that the United States can speak with one voice; (4) through a government-private sector body provide competitive grants and contracts to organizations which can define appropriate roles for facilitiating U.S. influence over international standards; and (5) provide technical experts to participate in international standards development from such agencies as the Food and Drug Administration.

**Westinghouse
Electric Corporation**

Westinghouse Building
Gateway Center
Pittsburgh Pennsylvania 15222

August 29, 1989

Mr. Doug Walgren, Chairman
Subcommittee on Science, Research and Technology
U.S. House of Representatives
Suite 2321
Rayburn House Office Building
Washington, DC 20515

Dear Mr. Chairman:

Thank you for your letter of August 3, 1989, in which you asked that I respond to a list of questions arising from my testimony before your Committee on July 25, 1989.

My response is attached. In each case, I am speaking on behalf of Westinghouse Electric Corporation.

I appreciated having the opportunity to give testimony on the subject of International Standards. I would be pleased to answer any additional questions you may have in the future on this subject.

Sincerely,

Ray Weser

R. A. Weser
Director, Strategic Resources
Europe/Africa/Middle East

Attachment

1. QUESTION: We have been told that the American/Saudi Roundtable has had difficulty raising $400,000 in funds for NIST Research Association in the Saudi Arabia Standards Organization (SASO). Given the huge market that is at stake, and given the U.S. participation in SASO is so important, why is industry having so much difficulty in raising the funds?

   ANSWER: The American/Saudi Roundtable has raised about $185,000 under this program from the U.S. private sector and hopes to raise more. Not all companies doing business in Saudi Arabia have contributed. The following are some reasons for lack of full participation:

   - Not all of the companies interested in Saudi Arabian standards are a member of the American Saudi Roundtable.
   - Some companies selling products in Saudi Arabia now, may not understand the potential significance of the Saudi standard-setting exercise. Many do not realize that without U.S. participation to counter the active participation of government-funded experts from other countries, new standards could be adopted which have the effect of forcing them from the marketplace.
   - In many countries throughout the world, and specifically in Saudi Arabia governments, have a preference of working with other government organizations to carry out functions such as standards. Therefore, government involvement and participation is a necessity to obtain cooperation from government agencies.
   - Government involvement is required because of the diversity of various business sectors that are covered by standards in Saudi. U.S. firms are usually involved in the very narrow sector of business and cannot afford the individual cost of supporting standards specialist.

2. QUESTION: Why hasn't government and industry in the United States been as active as the Western Europeans in promoting their standards in developing countries?

   ANSWER: Many of the standards currently existing in the developing worlds were imposed by foreign colonial powers (countries in Western Europe). The Europeans have a strong vested interest in seeing that the now-free developing countries retain the old standards to the maximum extent possible. U.S. standards are also widely used in developing countries because U.S. products have a strong reputation and because in the 1950-1980 period, the U.S. was a major donor of development assistance.

U.S. industry has been less active than its European counterparts because the U.S. is generally less export-oriented. Many U.S. firms are not aware of the threat to future foreign market share posed by aggressive standards promotion activity of competitors in Europe.

It is important to remember that Europe, being in general more export-oriented, has often sought to produce goods to standards which will enjoy the widest acceptability in world markets. European firms are much more likely to produce to ISO and IEC standards than U.S. firms are. In addition, where there is a chance to sell in a very large market, such as the United States, European firms often consider it worthwhile to set up a production line using the American standards.

Finally, the U.S. government has traditionally been reluctant to intervene in the standards area the way in which European governments have.

3. QUESTION: Given the reported difficulty in raising private money to fund an American standard expert in Saudi Arabia, what are the prospects for a privately funded program to support standardization activities in other developing countries?

ANSWER: The prospects for mounting similar U.S. private sector-funded programs in other developing countries are dim. The Europeans, as I mentioned above, are active in promoting use of their standards by developing countries. European governments have seen fit to assist the private sector in this type of activity. The European view seems to be that the international standards-setting activity is a type of public good. As in case of the roads, bridges, and national defense, it is expected that government will play at least some supportive role. At a minimum, it appears that in virtually all developed economies, some government seed capital is needed to encourage private firms to contribute resources to these programs.

4. QUESTION: What is the appropriate federal role in facilitating U.S. participation in international standards?

ANSWER: The federal government should consider establishing and supporting an industry-led consortium which would implement programs such as the SASO exercise, using U.S. government standard experts. The initial government contribution would serve as seed money which would lead those sectors of our economy currently inactive in international standards matters to assume more supportive roles. This type of team effort would reap great benefits for industry and government alike. It would create new jobs, reduce the trade and budget deficits and generate more tax revenues.

APPENDIX

For The Record

ANSI

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MANUEL PERALTA, President
212.642.4949

August 8, 1989

The Honorable Doug Walgren, Chairman
Subcommittee on Science, Research
and Technology
2319 Rayburn House Office Building
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

As a witness before the Subcommittee on Science, Research and Technology on July 25, 1989, I have edited and am returning the hearing transcript fowarded to me for review. I would also like to request that the following information be included in the hearing record:

Page	Line(s)	Proposed Wording
44	1024	mentioned earlier, ANSI represents the U.S. in ISO and IEC, and
46	1059	the last thing I would like to do is
66	1534-1535	I believe that there are a number of countries that have their activities based principally on a voluntary, private sector system.
77	1817-1818	funding shortfall or the the funding limitations result from the fact that

In understand that this letter may be inserted in the transcript in the form of an appendix and referred to by footnote in the main text.

Sincerely,

Manuel Peralta
President

MP:em

ANSI
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MANUEL PERALTA, President
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August 22, 1989

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research
and Technology
House Committee on Science, Space,
and Technology
Suite 2321
Rayburn House Office Building
Washington, DC 20515

Dear Congressman Walgren:

I very much appreciated the opportunity to testify on behalf of the American National Standards Institute, Inc. ("ANSI") at the Subcommittee's hearing on July 25, 1989 concerning international voluntary standards activities and the role of the federal government in those activities. As you and the other members of the subcommittee obviously appreciate, standards and certification activities have in recent years come to assume a more important role in international trade and the competitive position of the United States in an increasingly global economy.

As the coordinator of the voluntary standards system in the United States and the official United States member of and representative to ISO and IEC, ANSI has been and will continue to be responsive to the needs of American industry and the public as a whole. To that end, ANSI has long enjoyed, and sought continuously to further, a positive and productive working relationship with the federal government in the international standards area. That relationship can and should be continued and, in some respects, improved. Indeed, as I mentioned during my testimony, ANSI has been engaged in an ongoing dialogue with the Department of Commerce concerning the desirability of a more productive working arrangement between the private sector and government as regards standards and certification issues. Because you and other members of the Subcommittee expressed particular interest in ANSI's views on the proper role of the federal government in the process, I would like to take this opportunity to provide some additional details and to request that this letter be made a part of the record.

Historically, the relationship between the private sector and government with respect to international standards activities has been premised on the mutual acceptance and recognition of certain basic principles:

(1) The formulation of international trade policy for the United States is the responsibility of the federal government. That policy has been, and should continue to be, the realization of a global marketplace free from artificial barriers to trade in any form.

(2) Voluntary consensus standards that are developed and approved by private, non-treaty international organizations (e.g. ISO and IEC) are consistent with a free trade policy and should be encouraged.

(3) In accordance with our free enterprise system and considerations of efficiency and the proper allocation of resources, the United States should be represented in private, non-treaty international organizations by the private sector coordinator of voluntary standards development activity (i.e. ANSI).

With these principles in mind, it is possible to define with some precision the proper role of the federal government in international voluntary standards activity:

1. Government to Government Activities -- To the extent a foreign government seeks to employ standards and certification as a means by which to erect artificial trade barriers, the federal government should actively seek to address the problem on a government to government basis. Further, the federal government should actively seek to persuade foreign governments to accept international voluntary consensus standards to the maximum extent possible. Information bearing on issues of this type should be solicited from the private sector, but the principal actor should be government.

2. Private Sector to Private Sector -- In the standards arena the federal government should promote and recognize, domestically and abroad, the role of ANSI as the U.S. member of, and/or principal interface with, the private, non-treaty international standards bodies (e.g. ISO, IEC, CEN and CENELEC). To do otherwise serves to undermine ANSI's international role and relationships at a time when these are very important. Moreover, when government action is desirable to further U.S. positions and initiatives in such organizations (e.g. certification activity in Europe), ANSI would seek such action so that it can be quickly forthcoming after appropriate consultation and deliberation.

3. Increased Government Adoption of Voluntary Standards -- The federal government should actively encourage greater adoption of voluntary consensus standards by all branches of government -- federal, state and local. While OMB Circular A119 was an important step in this direction, still more could and should be done. Such action will increase the likelihood that U.S. voluntary standards will be used as models for international standards. Moreover, it will send the right message to foreign countries concerning the value of voluntary standards and the willingness of our government to accept such standards.

4. Greater Educational Efforts -- A great strength of the U.S. voluntary standards system is that it is intended to, and in most instances does, produce an efficient allocation of resources at little cost to the government and taxpayer. Where international standards are important to a particular industry, that industry normally can be expected to commit the necessary

resources. In certain circumstances, however, an industry may not be sufficiently aware of the importance of international standards. Increased educational programs sponsored by the federal government concerning the importance of standards are a vitally important information tool that would go a long way towards assuring greater participation in international standards work and optimal resource allocation by industry.

5. Greater Participation in the Voluntary Standards Process -- Employees of the federal government have long participated in voluntary standards development activities where the interests of government are perceived to dictate such involvement. ANSI believes the present level of government employee participation should be increased as should financial support necessary to permit such activity. Further, more government agencies should be encouraged to join ANSI, participate in ANSI's Government Member Council, and seek positions on ANSI's Board of Directors.

6. Government Funding as Benefactor -- The U.S. government, as consumer, is probably the single largest beneficiary of the voluntary standards effort in this country. Despite this fact, the system has never sought to request other than a minimal financial commitment from the federal government. Indeed, government members of ANSI pay less dues than many private companies and organisations. It may be that government member dues should be increased, and ANSI is currently evaluating that issue. If an increase is determined to be appropriate, it should be supported by the federal government.

Moreover, a substantial portion of ANSI's revenues, and those of many standards developers, are derived from the sale of publications and standards. It is regrettable that certain agencies in the federal government utilise unauthorized copies of these materials, thereby depriving the copyright holders and vendors of valuable revenues that otherwise would be achieved through greater sales. A concerted effort should be made to discontinue this type of activity by government.

7. Greater Incentives for Industry Participation -- The federal government should seek to create an environment that encourages maximum participation in international voluntary standards efforts by private industry. If necessary, additional incentives should be considered including favorable tax treatment for costs incurred by U.S. companies involved in national and international standards activities. For example, encouraging the tax treatment of standards activities as a research expense.

8. Closer Working Relationship with the Private Sector -- Most importantly the government should actively seek to ensure better communications with the private sector and a more unified effort. ANSI believes that it would be desirable to establish a coordinating council made up of senior representatives from the private sector and government to work in partnership. The objective of the council would be to better coordinate and integrate U.S. activities regarding EC'92 ... and, raise U.S. awareness of the strategic significance of standards technology to global competitiveness.

The objectives of the private sector/government executive coordinating council would be to:

- Conduct open dialogue on issues of mutual interest ...
- Achieve common sense of purpose ...
- Share perspectives and agenda for action ...
- Effectively focus and coordinate efforts ...

The key principle underlying the council concept is ... existing roles and responsibilities including the private sector and government are retained ... and divergence of action or duplication is to be prevented. It is particularly important that the government not usurp, but rather supports and compliments, the efforts of the private sector in a constructive partnership. ANSI stands ready to work with the Department of Commerce in the development of an appropriate national partnership.

In closing, I would like to again thank you and the Subcommittee for your interest in this area and your consideration of ANSI's views. If you should have any questions or desire any further information, please do not hesitate to contact me.

Sincerely,

Manuel Peralta

MP/0051p

STATEMENT OF
GARY J. HANDLER
VICE PRESIDENT, NETWORK PLANNING
BELLCORE

BEFORE THE SUBCOMMITTEE ON SCIENCE,
RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES
July 25, 1989

My name is Gary J. Handler, Vice President of Network Planning at Bell Communications Research, Inc. ("Bellcore"). I have spent 24 years at Bell Telephone Laboratories, AT&T, and Bellcore working on telecommunications research and development, and network planning. My current responsibilities include planning for telecommunications services, architectures, standards, and conceiving and using new network technologies. I am a member of the Board of Directors of the American National Standards Institute (ANSI), and Vice Chairman of the Telephone Exchange Committee of the Exchange Carriers Standards Association (ECSA). Given my participation as a member of ANSI and ECSA, I welcome the opportunity to submit a written statement to be included in the official record of the Subcommittee's hearing of July 25, 1989 on the issues surrounding whether the United States Government should increase its involvement in international standards setting.

Bellcore is a major telecommunications technology consortium owned by the seven regional Bell telephone companies. It is engaged in leading-edge technical research for its owners and in the technical support of their development and planning for the introduction of new exchange and exchange access telecommunications service capabilities into their networks. A crucial part of its mission is to help preserve the technical integrity of the national telecommunications network infrastructure.

In support of statements in the testimony of others, notably Mr. Manuel Peralta, President of ANSI, who appeared before this Subcommittee, Bellcore endorses continuation of the voluntary system of industrial standards that has proved so effective and productive in the United States. The principal domestic telecommunications standards body, the T1 Committee, is sponsored by ECSA and accredited by ANSI. T1 operation is governed by the ANSI due process rules of procedure. Nevertheless, there are certainly aspects of the voluntary standards process, especially its international extensions, which could be enhanced with appropriate government focus, without changing the fundamental nature of the process. Principally, more incentives and encouragement for industry cooperation in formulating standards proposals and implementing standards adopted by accredited industry standards bodies is needed. Currently pending before the Economic and Commercial Law Subcommittee is legislation that would amend the National Cooperative Research Act (NCRA) to extend its protections to joint production ventures. This antitrust reform legislation should also include protection of the joint venture to cover both recommendations of a proposed standard made by the joint venture members to an accredited industry consensus standards body, and their joint implementation to a standard adopted by such a body.

Some recent successes, especially in the area of telecommunications standards are worth noting. Synchronous Optical Networks (SONET) is an activity that began and matured in the US standards environment and was successfully "exported" into the international standards arena for adoption. These high speed transmission system interfaces, which operate at 50 million to 2 billion bits per second (50 megabits/second to 2 gigabits/second) are vital to futuristic telecommunications. They provide the ability to interconnect on a worldwide basis, the high bandwidth transmission to support data and video services. In this case, the US standards process worked well in advancing these standards worldwide.

Broadband ISDN is another recent example of where US domestic standards organizations have demonstrated world leadership and have helped to influence the achievement of agreements internationally that will help shape the world telecommunications environment of the future. Interestingly, US leadership and innovations have just recently been challenged and modified in the international BISDN standards arena by a combination of European and Japanese opposition.

Today, a global perspective is appropriate for almost every aspect of our lifestyle, whether considering the globalization of markets or the information and communications needs of private citizens. Users -- simple to sophisticated -- require and expect that whatever and wherever they are communicating, the communication should be "transparent" in terms of functionality and quality. The complexity of the environment has never been considered an excuse for not meeting customers' expectations.

Today's global economy also has equipment providers seeking foreign markets for their manufactured goods and service providers seeking foreign opportunities for the sale of services. The law of "economy of scale" encourages these entities not to offer different products or services in different markets, but rather to have uniform or compatible products in all markets. It then behooves each of these multi-national vendors to "export" their respective country's way of providing service (or more precisely, their products' way of implementing a service) as broadly as possible to favor their sales opportunities.

The complexity of national and international telecommunications has always been implicitly assumed and understood. This has readily convinced the world telecommunications community of the need for international standards and cooperative organizations. Efforts are being made through organizations such as the International Standards Organizations (ISO) and the Consultative Committee for International Telephony and Telegraphy (CCITT), for encouraging technical and operational agreements between countries.

It is clear that outside the United States there is a strong recognition of the realities of international competition and cooperation. Foreign entities located in countries much smaller than the US have long recognized the need for compatibility within their countries, but more importantly, the absolute need to engineer their telecommunications networks and products to the specification of neighboring countries and to foreign major markets (like the United States). They realize that technical compatibility among their products and services--interoperability

-- creates economies of scale with cost savings that result in lower, more competitive prices worldwide. This is evidenced by the following long established practices in the European telecommunications industry:

- National standards are typically brought into line with CCITT recommendations to ensure service compatibility across Europe and to favor European product compatibility within all of Europe. Efforts for EC 1992 have strong requirements for using only standard equipment and services.
- As entities outside Europe, e.g. the US and Japan, have become more active and influential in CCITT, the Europeans have attempted to coordinate their efforts in the CCITT through pan-European committees that review in advance their individual standards strategies and technical contributions e.g., the Conference of European Post and Telecom Administrations (CEPT). More recently, they have created their own regional standards body, the European Telecommunications Standards Institute (ETSI). They are also active in US standards bodies, such as the T1 Committee.
- The Europeans have tended to retain control of at least their basic telecommunications services through

their government Postal, Telephone, and Telegraph Administrations (PTTs). These PTTs have been sensitive to the need for intra-country and pan-European consistent network infrastructures.

The practices in Japan are also well known especially with regard to their international cooperation among otherwise competitive industrial entities. As a result, Europe and Japan are catching up with America in many areas and beginning to surpass the United States in the development of state-of-the-art services and products that successfully interwork to permit their public networks to evolve into all-digital information superhighways.

The Integrated Services Digital Network (ISDN) is a telecommunications network architecture that permits the seamless transport of customer controlled voice, data, and video information in digital form via a standard set of interfaces. It, like most other telecommunications services, cannot successfully happen, however, without substantial cooperation within the industry between vendors of switches and terminal equipment and carriers providing segments of the end-to-end information transport path. Joint ventures and agreements are needed to work toward technical compatibility among manufacturers, carriers, and other service providers.

ISDN, in short, requires coordinated planning. The reward is a cohesive structure into which future products and service features can be compatibly manufactured and deployed.

The Europeans have shown a substantial commitment to a common timetable for the joint development of uniform interfaces and the creation of a mass market large enough to support new services. The European Community has agreed to cooperate to build a transnational broadband backbone network to implement future services, such as HDTV transmissions. In addition, the member states are cooperatively undertaking significant joint research and development in advanced communications and information technologies.

The Japanese government also is coordinating the development of its telecommunications infrastructure and intends to invest over $120 billion before 1995 for the development of a digital broadband network infrastructure.

The US is a country where multi-vendor cooperation is needed more than anywhere in the world. Our industry structure, developed through divestiture and regulatory policies, has totally fragmented the telecommunications industry. Such fragmentation creates disincentives that are discouraging cooperation and coordination. Thus, in contrast to Europe and Japan, in the US we have proceeded with ISDN development in segments resulting in isolated islands of ISDN capabilities implemented in customer premises equipment and certain network switches that do not interact as required and, therefore, cannot be interconnected. This is not due to a lack of knowledge or a lack of technology. While the US has had a significant successful domestic standards effort on stand alone ISDN standards, much of the networking standards have been slowed due to the need for more cooperation among the players. The problem is also in joint implementation of the technology. Product suppliers perceive few positive incentives to cooperate even where the result would be a more efficient network service for the customer because they perceive significant risks -- including potential antitrust liability. A positive step to remove some of the potential threat of antitrust exposure is to build upon the joint production venture legislation currently pending in both the House and the Senate. We support this legislation; however, we believe that the legislation should be amended to include protection for joint standards setting-related activities that are part of a joint research and development or production venture.

In short, the domestic voluntary standards organizations have been and continue to be successful. This is evidenced by US leadership and contributions to international SONET and broadband ISDN standards. Where the US does run into problems in the international arena is when it collides with the Europeans and Japanese who use standards as a strategic competitive tool in the global marketplace. Furthermore, US companies are hampered domestically from being able to effectively cooperate in implementing an industry standard which would lead to compatible products and services useful to customers. Thus, while the strength of the voluntary US standards process must be emphasized and supported, two points are worth noting:

1) In telecommunications, the CCITT plays a central role in international standards, and this committee of the International Telecommunications Union regards the US State Department as the "official" member of CCITT. A significant cooperative partnership, therefore, already exists between the voluntary industrial standards groups which create national telecommunications standards and provide the bulk of technical expertise for international standards work, and the government which provides the strategic filter on technology and the voting power in CCITT. This could be enhanced further to the extent that the State Department

listens fully to all entities that have the technological expertise to provide effective technical leadership in the field.

2) There must be positive steps taken to encourage the level of industry cooperation that is required to create and implement standards to build a national state-of-the-art telecommunications infrastructure, and to transfer those results into the international arena. Antitrust reform in the context of legislation already under consideration in Congress to amend the NCRA is one such positive step.

To conclude, US competitiveness in the "information age" is dependent upon the creation of an information networking infrastructure, based on standards adopted by consensus and cooperation in the production and deployment of technology. The Government must adopt a national policy to encourage the cooperation of multiple players that create this infrastructure. The promise of the information age depends in large measure upon the willingness of industry to achieve cooperative solutions to compatibility problems that would otherwise prevent the deployment of workable services. Such joint and cooperative activities, including acceleration and effective use of national consensus standards, can lower costs to everyone in the chain producing telecommunications products and services.

COMMENTS
of the
COMPUTER AND BUSINESS EQUIPMENT
MANUFACTURERS ASSOCIATION (CBEMA)

ON INTERNATIONAL STANDARDIZATION:
THE FEDERAL ROLE
to the SUBCOMMITTEE
on
SCIENCE, RESEARCH AND TECHNOLOGY
HOUSE COMMITTEE
on
SCIENCE, SPACE AND TECHNOLOGY

JULY 25, 1989

Computer and Business Equipment Manufacturers Association
311 First Street, NW, Suite 500 • Washington, DC 20001 • 202/626-5733

COMMENTS OF THE COMPUTER AND BUSINESS EQUIPMENT MANUFACTURERS ASSOCIATION ON
INTERNATIONAL STANDARDIZATION: THE FEDERAL ROLE
TO THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
JULY 25, 1989

The Computer and Business Equipment Manufacturers Association (CBEMA) represents the leading edge of American high technology companies in computers, business equipment and telecommunications. Its members had combined sales of more than $230 billion in 1988, representing 4.8% of our nation's gross national product. They employ about 1.2 million people in the United States.

CBEMA members are responsible for approximately 21% of all industrially funded research and development.

In 1988, the U.S. computer and business equipment industry had exports of $27.706 billion and imports of $27.050 billion. The trade surplus was $656 million.

CBEMA has been very active in the national and international standards work of the Information Technology industry. It has served as the Secretariat for the ANSI Accredited Standards Committee X3, Information Processing Systems, since it was formed in 1960 and serves as the Technical Administrator for the U.S. Technical Advisory Group (USTAG) for ISO/IEC Joint Technical Committee 1 (JTC 1) on Information Technology the largest standards activity in ISO and IEC.

The following are CBEMA's answers to the nine questions posed by the Subcommittee:

1. How significant is U.S. participation in international organizations?

International standards are important to the Information Technology (IT) industry. U.S. IT companies are major exporters to developing as well as developed countries. U.S. participation and influence in international standards development is a critical factor in our international competitiveness.

2. How does the national standardization system in the U.S. compare with its counterparts in other countries? Is the current system in the U.S. adequately equipped to assist American industries in representing their interests in international standards organizations?

In contrast to most other countries, the national standardization system in the U.S. is a private sector initiative, independent of government control.

CBEMA has served as the Secretariat for ANSI Accredited Standards Committee X3, Information Processing Systems, since it was formed in 1960.

CBEMA also serves as the Technical Administrator for the U.S. Technical Advisory Group (USTAG) for ISO/IEC Joint Technical Committee 1 (JTC 1) on Information Technology.

The U.S. IT industry is adequately equipped to represent its interests in international standards organizations. Nevertheless, as with any operation, it can be improved.

CBEMA is working on this. We would encourage more active participation by the users, producers and government.

3. Is there an appropriate role for the Federal government in facilitating, coordinating, or even subsidizing U.S. participation in international standardization activities?

The OMB Circular A-119 defines the role for Federal government participation in international standardization activities.

U.S. government funding would be much less needed if all agencies were encouraged to be ANSI members in general, and X3 members in the case of IT standardization, or otherwise participate in standards when such activity contributed to the effective operation of the agency.

4. What is the proper balance between government support for and government control over standardization activities?

The Government should participate in development of voluntary standards and promote their use for government purposes in accordance with OMB Circular A-119, such as NIST/NCSL (National Computer Systems Laboratory) has done with GOSIP (Government Open Systems Interconnection Profile).

5. To what extent might EC 1992 standardization initiatives affect international standardization and U.S. participation in those activities?

EC standardization initiatives have brought the 12 EC member countries to the point of recognizing the value of international standards over unique national standards. The IT industry has recognized this trend for several years and has organized itself in a way to respond effectively to these developments. As such, the U.S. IT industry has been a heavy participant in international standards and has been regarded as taking leadership in this field. Private sector relationships between the U.S. and European fronts have been established many years ago in this area.

The area of greater concern is in the implementation of standards and their related testing, certification, accreditation and quality policies. This is where the trade barriers could be erected.

CBEMA has prepared a paper setting forth the views of its member companies on the subject of standards, testing, certification and accreditation in general and with regard to the EC in particular.

We are submitting our paper herewith and request that it, along with these comments, be made part of the record of your hearing on International Standardization: The Federal Role, which took place July 25, 1989.

6. Is the failure of the United States to convert to the metric system at the same time as its trading partners putting the U.S. at a disadvantage in international standards?

The IT industry recognized and adapted to the metric requirements to the degree necessary several years ago. This has not been a trade barrier in our industry.

7. What is the appropriate U.S. role in Saudi Arabia standards development? What parts of this role should be carried out by the private sector and what parts by the Federal government? Why has the private sector been so slow to contribute to the U.S. effort?

The U.S. should strongly urge Saudi Arabia to adopt and implement voluntary international ISO & IEC standards. The private sector and the Federal government should play an equal role in this effort.

The appropriate organizations to assist Saudi Arabia and other developing countries in establishing national standards programs should be the voluntary international standards organizations, ISO & IEC. All the member countries of these organizations should contribute to whatever assistance is required to get these countries into a standards program.

8. What standards development assistance should be given to developing countries?

In the absence of an ISO/IEC assistance program it would be in the combined interest of the U.S. federal and private sectors to provide some form of assistance to developing countries at least to the extent that other developed countries are doing this. The degree of assistance should be in proportion to the market potential for each particular segment of U.S. industry.

9. How can the United States integrate standards assistance into our trade policy? What are the consequences of not doing so?

The Trade Act of 1988 provides for NIST to cooperate with the government of other nations and international organizations in establishing standard practices, codes, specifications, and voluntary consensus standards. In keeping with its policy to promote exports, the Federal government should authorize the necessary resources to accomplish this.

We are told that European and Japanese competitors are providing technical assistance gratis to developing countries on a government-to-government basis with the hope that the standards adopted will be compatible with their own products. If the U.S. does nothing to counter this activity, the standards adopted by these developing countries may be incompatible with our products and we may be locked out of those markets.

The GATT Standards Code, approved by Congress as well as our leading trading partners, seeks to prevent the creation of product standards which discriminate against import competition. The U.S. trade policy should encourage developing countries to become signatories to the GATT Code and to adhere to it.

CBEMA

CBEMA STATEMENT ON STANDARDS, TESTING AND CERTIFICATION

JULY 25, 1989

In 1992, there will be an economic United States of Europe. Goods and services and people will move as freely between those countries as they do here between states. Europe will be the world's biggest market - 320 million people with a Gross Product half again as big as Japan's and equal to our GNP.

CBEMA is concerned about the effect this will have on our members, our industry and the United States. CBEMA members are thirty-one of the largest high technology companies manufacturing computer, business and telecommunications equipment in the U.S. In 1988, CBEMA members had combined sales of more than $230 billion worldwide, representing 4.7% of our nation's Gross National Product. This included substantial sales to nations in the European Community.

Among the U.S.'s top trading partners, the United Kingdom and Germany alone were responsible for nearly 21% of the U.S. information technology industry's 1988 exports.

CBEMA has concerns with policy areas where U.S. companies believe that specific decisions may enhance or reduce their opportunities to compete in a more open EC market. One if these areas is technical standards, and related testing, certification and accreditation.

Our concerns can be stated in two forms:

I. General concerns for U.S. industry, and

II. Specific concerns for the Information Technology industry.

We would like to address each of these in this statement.

I. General Concerns for U.S. Industry

The European Community intends to establish EC-wide standards and certification procedures so that products meeting "essential" health, safety and environmental requirements (e.g., Euro-beef, Euro-beer, Euro-bread, Euro-ice cream) as stipulated by new EC Directives can be marketed freely throughout the Community. These new directives could have a powerful influence on all international standards and a major impact on current and future access of U.S. producers to the EC market.

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Harmonization Directives may be framed, inadvertertly or not, to exclude or hinder the entry of U.S. products into the European market. Of furthersignificance will be the effect on U.S. imports from Europe, since their products are very likely to be less costly due to economic benefits derived from standardization.

Europeans, especially the French and Germans, already dominate many international standards writing groups. They have always known that the people that make the rules are ahead of the game.

CBEMA supports the EC's unified approach to standards as a way to liberalize the movement of goods throughout the Community, provided that new EC-wide standards and criteria for certification and testing procedures are not formulated in such a way as to hinder market access for U.S. exports. U.S. companies with production facilities in Europe believe that they will be able to rationalize production across national frontiers to a much greater degree than at present. U.S. exporters may achieve comparable benefits. Whatever standard is adopted for a product, the potential U.S. exporter will be assured that complying with this standard provides access to the entire EC market.

However, the EC standards process could create new standards barriers between the EC and all other markets. To counter this possibility, CBEMA firmly believes that, just as participation in our voluntary standards process is open to them and others, the EC should allow interested U.S. parties to participate in its process of developing EC-wide standards and criteria for testing and certification.

Further, the United States Government should strongly emphasize that EC-wide standards and certification requirements must not discriminate against U.S. products. To prevent such a situation from arising, the EC should:

- Adopt voluntary International Standards Organization (ISO) and International Electrotechnical Commission (IEC) standards as EC-wide standards. U.S. companies should have greater access to the EC's process of drafting standards and interested U.S. companies and other industry experts should have the opportunity to comment on EC draft standards while there is still time for their comments to be considered.

- Make provision for the mutual recognition of test data for the purpose of testing and certifying that U.S. equipment and products meet European standards and vice versa. The lack of mutual recognition for testing and certification procedures will severely limit the ability of U.S. firms to market their products throughout the EC. U.S. manufacturers may have to make costly modifications to their products in order to meet Community-specific requirements, and there could be lengthy delays in sales due to the need to get products tested and certified in an EC country.

A recent draft proposal, for example, indicates that self-certification by non-EC producers would be allowed only when EC-established design standards are met. By contrast, the thrust of internal EC harmonization rules and of current international efforts to improve international recognition is that mutual recognition should be based on performance qualities, not design of the product. Also, third-party testing would have to conform to established EC protocols, which can mean an expensive re-testing for a non-EC producer. Finally, existing bilateral recognition agreements between U.S. and EC member states' standards bodies could be nullified for any product, if either the EC itself or any single member state establishes a standard through formal regulations, rather than voluntary standards.

It is essential that the United States pursue a strategy that will assure continued access to the European market, reduce trade barriers, and take advantage of the opportunities for expanded trade that a unified European market will bring. This will require active U.S. participation in the integration process before it is completed.

In the U.S., the voluntary consensus standards development process is open to "all interested parties." This includes Europeans as well as others. We believe the EC process should be equally open to the USA.

The American National Standards Institute (ANSI), through its administration of the U.S. international voluntary standards programs, can facilitate U.S. leadership in global standardization through ISO and IEC. The U.S. Government plays an important role in treaty organizations such as CCITT (translated: the International Telegraph and Telephone Consultative Committee). Both of these activities are highly dependent on and need the strong support of U.S. industry's technical and financial investment in standards activities. All these groups should continue to foster global rather than regional standardization while maintaining close cooperation with regional standards organizations such as CEN (translated: the European Committee for Standardization), CENELEC (translated: the European Committee for Electrotechnical Standardization) and ETSI, the European Telecommunications Standards Institute, in Europe and the Pacific Area Standards Congress (PASC) in the Pacific rim.

One of our concerns is the process of developing new European technical standards to replace national standards. An expedited EC-wide standard-setting procedure has been put in place as part of the EC-92 program to ensure that differences in technical standards are eliminated as a barrier to trade within the EC. The form these standards ultimately take can significantly affect U.S. global interests. It will be helpful to replace existing divergent national standards with EC-wide standards, as long as new standards are identical to or compatible with voluntary international standards, and create no new trade barriers. Under the GATT Code, the EC is required to avoid adoption of "technical regulations and standards...which would create obstacles to international trade." We define the issue concerning standards as "timely transparency," including access by U.S. industry to information as new standards are developed and the opportunity to provide comment on EC standards proposals on a timely basis.

In the area of certification, the major issue is access to all testing and certification programs in the EC for goods produced in the United States, on the same basis as those produced in the European Community.

We believe that these concerns are of such importance that it would be in the interest of the Community and the United States to improve communications on these issues.

The EC Commission has assigned the task of formulating and harmonizing the technical specifications for standards to non-governmental European regional standardization bodies, i.e., CEN for non-electrotechnical products, and CENELEC, for electrotechnical Standards. ETSI will take over the telecommunications standards-setting role performed by CEPT (translated: the European Conference of Postal and Telecommunications Administrations) the organization of the European Postal, Telegraph and Telephone Administrations (PTTS). Participation in ETSI is not restricted to the PTTs as is CEPT.

The stated principle of Europe's standards harmonization is for the EC to adopt internationally agreed upon standards wherever possible (e.g., electrical safety and agricultural equipment). The challenge for the EC is for CEN, CENELEC and ETSI to continue to operate under the policy of giving first priority to international standardization and only undertaking regional standardization where ISO, IEC or CCITT are unable to make satisfactory progress.

We are encouraged by the announcement of the joint chairmen of CEN and CENELEC, that they intend to provide regular public notice of standards projects being undertaken through the CEN/CENELEC private sector process in Europe. This could be a very helpful step in improving both the timeliness and transparency of information on the EC standards process. Recently, ANSI applied for Observer membership with CEN and CENELEC and is working on an agreement to exchange draft standards. CBEMA has been successful to some extent in gaining some access to ETSI. We have attended meetings of ETSI General and Technical Assemblies as an invited observer.

Once EC-wide standards are in place, the EC will have to implement a harmonized approach to testing and certification, as well as provide for the mutual recognition of accredited national laboratories. The EC Commission has proposed to create an institution which would establish criteria leading to the mutual recognition of national testing competencies and conformity marks.

To date, U.S. firms have had very limited access to EC standardization bodies, and the EC Commission consults only with the EC industry and member states in laying out essential requirements. Given the potential magnitude of effect on U.S. industry, the issue of standards harmonization is one of highest priority.

We believe that a broader two-way dialogue is advisable. Specifically, we recommend that the U.S. Government take the initiative in suggesting the establishment of a mechanism for discussion between EC and U.S. broad-based private sector bodies on standards and certification. To establish the basis for this, the U.S. private sector should be willing to develop a set of general principles.

We want to make it very clear that we are not supporting any role for the United States Government in the setting of voluntary standards, which will emerge under the EC's "New Approach." But because we are very significant trade customers to each other, we want to ensure that both sides are fully aware of the potential impact of standards before they reach the final adoption stage. We would like to point out that the U.S. voluntary standards process is open to participation by EC members as well as other countries.

II. Specific Concerns of the Information Technology Industry

CBEMA's objective with regard to standards, testing, certification and accreditation is to be able to test our industry's products once to a single standard or set of standards recognized and accepted worldwide and then be able to market them anywhere in the world.

Information Technology products must conform to two different types of standards:

- Those covering health, safety and environmental issues, national security and, in some instances harm to telecommunications networks.

- Those covering the area of providing functional capabilities to the user.

One of the concerns of the Information Technology industry is an apparent trend in the EC and elsewhere toward a comprehensive third party testing and certification requirement - in the area of providing functional capabilities to the user - imposed upon our industry either by regulation or by unrealistic user expectations.

CBEMA believes that this emphasis on certification of functional capabilities is not in the best interests of users or producers of Information Technology products. We are enclosing CBEMA's position paper on this critical issue for your information and request that it be made part of the record.

CBEMA appreciates the opportunity to submit this statement to the International Economic Policy Subcommittee and would be pleased to respond to requests for additional information.

CBEMA POSITION ON STANDARDS, TESTING, CERTIFICATION AND ACCREDITATION

o EXECUTIVE SUMMARY

CBEMA advocates the principle of manufacturer self-testing and declaration of conformance to standards particularly in the area of providing functional capabilities to the user. Under this principle, the manufacturer may exercise its option to conduct tests on its own products and services and declare that they are in conformance with the relevant standards.

CBEMA recognizes and agrees that certain products must be tested to determine their conformance to base standards, functional standards, e.g., International Standardized Profiles, and purchasing specifications, e.g., MAP/TOP, GOSIP, CALS. CBEMA supports the use of an internationally accepted conformance testing methodology based upon international voluntary consensus standards. This can provide benefits for producers and users alike. However, CBEMA questions whether it is appropriate to require certification of functional capabilities.

CBEMA is not opposed to third party conformance testing for those who do not have the capability or, for other reasons, do not choose to self-test.

CBEMA believes that a Third Party Testing and Certification system, imposed on the IT industry either by regulation or by unrealistic user expectations, would add costs ultimately borne by the user without any identifiable commensurate benefit. In addition, a limited number of qualified third party test facilities could result in queuing problems for manufacturers. This would cause delays in introduction of products into the marketplace and delivery to the users. Such delays would adversely affect the industry's revenues, growth rate and responsiveness.

All Certification can do in such an environment is create the potential for increased expense, more bureaucracy, additional regulation of products, user frustration, and impede what would otherwise be a free market beneficial to both vendors and users.

Finally, Certification may be used as a non-tariff trade barrier - especially when the certification authority is a national or regional government. A government can require that conformance tests be conducted in their country or region by their people and their testing houses using their tests (which may be unnecessarily stringent) and test tools (which may be different or unique). We have seen instances of this tactic in other product categories.

It is CBEMA's position that manufacturers' self-testing and declaration of conformance provides the best method for assurance that their products conform to standards, since the manufacturers have the primary responsibility for implementation of the standards in their products.

o PRINCIPLES ON SELF-TESTING, CERTIFICATION AND CONFORMANCE

CBEMA believes that the Information Technology (IT) industry should affirm the following principles, and that they should be a framework for any discussion on Certification and conformance.

1. Certification - the granting of a document declaring that a particular product conforms to a standard or set of specifications - should be limited to health, safety, environmental protection issues, national security and, where appropriate, homologation.

2. Conformance to base standards, International Standardized Profiles (ISPs) and procurement specifications is a requirement for achieving portability of assets and interoperability of IT systems. This conformance encourages the growth of the market and provides a basis of understanding of complex systems requirements to both the user and the provider. The ultimate purpose of conformance to standards is to benefit the user by increasing the potential market for systems that can interoperate and support portability of assets.

3. The systems that are being requested and provided in the commercial environment today are highly complex. Conformance testing is needed to assure both providers and users that the systems meet the specified requirements.

4. The standards from which conformance tests are derived should be international voluntary consensus standards as a first choice, with other voluntary consensus standards being a second choice. Such standards tend to represent a consensus of all affected parties, providers and users alike.

5. There should be only a single set of conformance criteria for each conformance test. The use of a single set of criteria will allow users and providers to understand the metrics of the system. This set of criteria should have worldwide recognition.

6. There should be a single set of test tools available and accepted on a worldwide basis. This will prevent the expenditure of scarce resources on a multitude of tests and test tools which may or may not produce the same results. Additionally, this will help to preclude the possibility of a single nation or region using the concept of conformance as a non-tariff trade barrier.

7. Providers should have the option to perform conformance tests as an integral part of the their development or manufacturing process and have the results stand on an equal basis with tests performed by third parties.

8. Because the provider may wish to use proprietary technologies to insure conformance, we believe that the Manufacturer's Declaration of Conformance should be an accepted statement of conformance. The Manufacturer's Declaration of Conformance should be seen as an assurance by the manufacturer that the product conforms to the applicable standards.

9. In any contract situation, the user has the right to demand that a vendor conforms to its purchase specifications and to request independent verification of the terms of a contract.

10. Third party testers must accept liability for their testing activities, thereby assuring that their tests are rigorous in methodology and have substantial meaning to the provider and user.

11. There should be procedures for accreditation of third party testing laboratories. These procedures should not apply to a manufacturer's testing operations.

12. There must be mutual acceptance of tests and test results by providers, Governments and users, domestically and internationally, on the part of all concerned.

13. All conformance and certification schemes should be economically and technically justified before being implemented.

o CONCLUSION

Providers are responsible for helping users to solve their problems - and users are responsible for clearly defining their needs and requirements. This is a mutually dependent relationship, and if the users and providers work together, then there is not a need for Certification. There is no need for the establishment of Certification schemes in order to insure proper implementation of IT standards. Users and providers have traditionally worked together to implement new technologies and find new solutions to complex systems problems. This cooperation has helped to create a formidable industry and has increased the benefits of Information Technology in quantum steps. There is no reason to doubt that this formula of cooperation will work equally well in the future. It is this cooperation between provider and user that has caused the industry to succeed and grow as it has - and it is this cooperation which, if left unregulated, will be the primary force in the continued growth of the industry and information technology.

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August 7, 1989

The Honorable Doug Walgren
Subcommittee on Science, Space
and Technology
2319 Rayburn House Office Building
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Dear Mr. Chairman:

I am responding to your letter of July 18 in which you requested that I address key issues being examined by your committee in the area of international standardization activities and the role of the US government. I am pleased to offer my thoughts on these issues which bear heavily on the future international competitiveness of the United States. I provide these comments with the benefit of the testimony of Ray Weser, Westinghouse Director for Strategic Planning, Europe, Africa and the Middle East who, along with other distinguished witnesses, participated in the July 25 hearing of the Science, Research and Technology Subcommittee.

In the area of product standards, the United States and other major manufacturing economies are at an important juncture. In the recent history of trading between the OECD countries, standards have occasionally served as deliberate non-tariff barriers. The creation of the GATT Standards Code as a result of the Tokyo Trade Round has given us a mechanism, at least among Standards Code members, for dealing with such cases. As industrialization spreads, many nations which were content to have standards imposed upon them by former colonial powers or major developed country producers are seeking to develop their own standards. These new standards will be based in large part on a pragmatic view of the world. In a few cases they may be devised to give advantage to national manufacturers, but in most instances they will be based on either an existing international standard or on the national standard of an important supplier such as the US, the EC or Japan.

Saudi Arabia and the Gulf Cooperation Council (GCC) states have invited a large number of countries to participate in a standards-setting exercise. The motivation appears to be non-protectionist. The Saudis and their Gulf colleagues wish to assure that the products they import meet safety, design and performance norms compatible with local conditions. Other countries in the Pacific rim, Latin America, and Africa will engage in similar exercises for similar reasons. We and the other major industrial economies of the world will in many cases be invited to provide our views by furnishing standards experts to participate in the exercise. In the case of the Saudi invitation, several countries have already accepted the invitation and have sent experts. The standard setting process has begun and over 600 standards have been drafted and adopted. US standards experts have not been present at these sessions. None of the 600 standards which have been adopted to date are US standards and many of them will prove to be incompatible with US standards.

Congressman Dymally has taken two steps to help insure that the US will be able to respond to future requests for participation in standards-setting. He was successful in amending the NIST Authorization Act to provide for a privately-funded program to assist other countries in the development of domestic standards that are compatible with standards used in the US. He has also introduced legislation providing for a pilot program of US government support to insure that we do not miss opportunities to influence the formulation of foreign standards. Most of the other countries participating in the Saudi exercise are doing so with significant government funding. Twenty percent of the total budget of DIN, the German standards organization, for example, is provided by the West German Government. I suspect that a major part of that government support is devoted to DIN international programs. I understand that witnesses at the hearing you held on July 25 described with admiration the effectiveness of EC countries and Japan in influencing standards setting in other countries as a result of government support.

The European Community is now embarked on a somewhat different exercise. There the existing product standards of twelve highly developed economies are to be rationalized into single harmonized standards (where health and safety are concerned) or subjected to the principle of mutual recognition. In this exercise the Europeans will not be inviting major non-EC trading partners to sit with them at the table. Where an international standard for a product exist, the EC has committed itself to consider using that standard rather than adopting a distinct European standard. Where an international standard does not exist, the likely outcome will be adoption of an existing European standard.

Two years ago, at the inception of the Single market exercise, US industry expressed strong concerns to the US Government that the EC procedure could result in the adoption of standards which were incompatible with those in the US, thereby worsening the market position of these firms in Europe. Over the last two years, the US government has been able to gain some assurances from the EC and the European Standards organizations that the EC 1992 standards exercise will not pose a barrier to US exports. The EC has promised for example, to give Non-EC countries an indirect voice in its standards-setting exercise. This promise envisages that US firms not based in Europe would have advance warning of plans, an early look at draft standards and a chance to provide their views indirectly (through ISO working groups). Those US firms with a presence in Europe will be able to influence the exercise directly through representation in a European national standards organization (e.g., DIN, AFNOR or BIS).

In his testimony, Ray Weser of Westinghouse argued for stronger government support of programs such as the Saudi Arabian exercise as well as the active participation of US government experts in discussions with host country experts. I would like to build on that recommendation. I believe that it should be possible to design an industry-led consortium which receives strong support from the federal government. It may be necessary to relax some anti-trust provisions to permit the consortium to carry out international trade promotion activities. The initial government contribution could serve as seed money (especially when combined with matching provisions) which would lead those sectors of our economy currently inactive in international standards matters to assume a more supportive role.

What would be the role of this industry-led standards consortium? In the area of international standards-setting, it would continue to take a strong interest in ISO and IEC activities, working to develop international standards where they do not currently exist. In the EC, the consortium should work closely with the US Government to exercise vigilance over the single market standards program. The US should continue its efforts to obtain observer status in CEN/CENELEC but I believe the major investment in resources should be devoted to efforts a) to prepare international standards in areas where they do not exist and b) to encourage increasing recourse to the metric system and international standards in the US. As for the newly-industrialized countries, the consortium should have in place a adequately funded program which would allow the posting of US standards experts overseas for long term periods in countries where the views of the US have been requested.

The Honorable Doug Walgren
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The future competitive position of the US depends on our ability to manufacture quality products to standards which insure the widest possible international sales. The US is starting to fall behind in the pursuit of this goal. There is no substitute for an activist program designed to disseminate US views and to move more rapidly toward the use in the US of international standards. Current experience in the US has shown that private sector effort is a necessary but not a sufficient condition for an effective program. To galvanize the private sector into greater activity, a catalyst of broad government support is vital. This joint private/public sector team approach will stimulate more exports, create thousands of new jobs in the US, generate more tax revenues and help reduce the US trade and budget deficits.

I appreciate having the opportunity to discuss my views on this subject with you and the members of the Science, Research and Technology Committee.

Sincerely,

John B. Yasinsky

THE VALUE OF CREATING STANDARDS FOR EMERGING TECHNOLOGIES

HARRY J. SHEETZ

American Institute of
Aeronautics and Astronautics

1989
Cesse
Annual
Meeting
Atlanta,
Georgia

The Value of Creating Standards for Emerging Technologies

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Abstract

There has been a growing awareness among the engineering and scientific community that standards and the precursor documents leading to standards are vital to the health of an industry. This has become even more evident with global trade increasing at an ever accelerating pace. The European Community (EC), the European Free Trade Association and indications of a Pacific Basin homogeneous community forming are examples of cohesive market trends. With the advent of collective markets come unified approaches to the development, production and selling of goods and services. These lead to documents which emerge as technical, financial and legal recommended practices, guides and standards.

This paper explores the value and approach to creating standards in a major facet of the new markets--emerging technologies.

Introduction

For several decades after World War II, United States' products and practices were a major influence on world trade, often as defacto standards. In recent years, formal standards created by international organizations, or in other countries through organizations having expertise in a particular field, have altered U.S. prestige. This erosion of U.S. influence has shaken the confidence of many United States manufacturers who, for many years, have not been particularly concerned with foreign competition or marketing beyond typical U.S. market boundaries. They have enjoyed 40% of the world's wealth with less than 5% of the world's population. The U.S. is now experiencing certain markets being dominated by a particular company in a foreign country who has taken the lead in an emerging technology by investing time, talent and funds.

Justification

In several instances, to capture a lion's share of a market, standards programs have been carefully developed by foreign competitors. If an organization can establish itself with a particular product and market the product successfully, then that organization is in a good position to define the standards which may set the stage in its production for years to come; a definite marketing advantage results. Tooling and dies are defined, materials specified, procedures developed and in some cases, colors, sizes and shapes established. Sometimes functions and interfaces such as have been demonstrated with communication functions and protocols developed by IBM have been accepted in a de facto manner.

De facto standards do not always result in the best standards. Once a standard has been set, it can be very difficult to change. Because other companies want to interface with a successful product, they will accommodate the established interface electrically, electronically, mechanically and sometimes with software, thereby embedding the new standard more deeply. If the standard has not been thought out and developed with all major uses and users in mind, then a diminished product line results. By diminished it is meant that other associated products may suffer by not being able to be designed optimally for reliability, cost and functionality.

In many cases, it is advantageous to compare and correlate data from different experiments so that sense can be made out of an emerging technology or claims can be justified. This includes not only domestic but international experimentation. The recent example of advances in superconductivity may be profitable to examine as claims on techniques and conduction are being announced monthly; but data, due to lack of instrumentation, calibration, material, and data reporting standards are lacking. The recent claims in the laboratory of nuclear fusion are another example of incompatible data comparison for the same reasons.

Methodology

How does an organization arrive at an optimally developed standard that benefits all? Will an organization create a standard that benefits the majority? Where does one limit one's resources for creating a universal standard? How does one assure compatibility with the majority of users?

It seems that there are procedures for establishing standards in most parts of the world. We must all do our part to see to it that harmony is a guiding incentive employed in developing technical recommended practices, guides and standards. First, we must make sure that the entities that are directly affected by our emerging technologies are brought into the decision making process early so that the best decisions will be made and expended cost, time and energy is maximized. The procedure is called consensus. In the United States consensus has been successfully recommended and implemented by the American National Standards Institute (ANSI) located in New York City.

Most major U.S. trade associations and professional societies adhere to ANSI's procedures for the development of consensus documents and use ANSI as a clearing house to avoid duplication, a distribution center, and a point of contact with other world standards organizations.

ANSI is the designated U.S. member of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), both headquartered in Geneva, Switzerland. ANSI has also established relations with the Pacific Standards Congress (PASC), European Telecommunications Standards Institute (ETSI), European Committee for Standardization/European Committee for Electrotechnical Standardization (CEN/CENELEC), Association Francaise de Normalisation (AFNOR), British Standards Institute (BSI), Deutsches Institut fur Normung (DIN), U.S. government agencies and others. ANSI is also trying to establish relationships with the standards activities in the European Community organization.

Cooperation with ANSI from standards producing bodies and government agencies is vital to the health of the U.S. marketplace and is certainly preferable to ill conceived, costly government regulations and de facto standards. Fortunately, the Department of Defense is recognizing the importance of nongovernment standards, and through the office of Director of Standardization and Data Management, is promoting the development of nongovernment standards, many of which will presumably be submitted to the rigors of association consensus procedures.

Through the influence of the Office of Management and Budget, Circular A-119, other federal agencies are also taking advantage of the availability of nongovernment standards.

If we all work together toward eliminating maverick standards, suggest and create international working groups to develop 'needed' standards, then we will be part of a larger, more comprehensive, harmonious plan to create a world which is a better and safer place for all to live. In the space field, the development of legal standards and procedures will help eliminate tensions and misconceptions of intent and help insure that we all understand international standards ground rules. International space, legal guidelines and standards that we should consider developing include: legislative, administrative, and enforcement standards and admissible evidence and litigation guides.

Conclusions

To create a world-wide harmonious market environment to benefit all, we should consider:

- Discouraging the development and implementation of de facto standards.
- Encouraging the development of guides, recommended practices and standards at an early stage of an emerging technology.
- Harmonizing domestic and international product ventures with our international trading partners.

The development of international standards greatly enhances communications which are necessary for world peace.

Acknowledgments

The author appreciates the contributions of M. Claire Johnston and James French to this paper.

Biography of Harry J. Sheetz III

Harry Sheetz has been involved in several engineering disciplines since he started working in engineering areas in 1951. He is a graduate of Drexel University, with a diploma in Mechanical Engineering, and a Bachelors of Science in Engineering, and has never ceased his educational efforts. He has helped design aircraft interiors, electronic components, computers and spacecraft. He has held research and aerospace managerial posts with RCA, Fairchild, AMSAT and Mitre Corporation. Mr. Sheetz is currently the Administrator for Standards with the world's largest and oldest professional society devoted to aerospace, The American Institute of Aeronautics and Astronautics, located in Washington, D.C.

STATEMENT BY
NMTBA - THE ASSOCIATION FOR MANUFACTURING TECHNOLOGY
TO THE
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
JULY 25, 1989

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I. INTRODUCTION

NMTBA - The Association For Manufacturing Technology, is a trade association representing over 300 manufacturing technology firms with over 400 plant locations.

Our members are engaged in the business of manufacturing the tools of manufacturing productivity including cutting, grinding and forming machines, universal measuring machines, and automated production systems. America's manufacturing technology industry accounts for a very basic and strategic segment of the nation's industrial capacity. Our industry builds the machines essential to this nation's military readiness and her ability to respond quickly and effectively in the event of a national emergency. Our product is the very essence of the industrial manufacturing process. We produce the "tools of production."

Machine tools are the foundation upon which America's entire manufacturing technology base rests; and the vitality of our machine tool industry depends upon the industry's ability to compete in the global market. Therefore, the European Community's 1992 internal market initiative (EC '92) is of vital concern to America's machine tool manufacturers.

Several organizations, such as the National Association of Manufacturers, the U.S. Chamber of Commerce, and the American National Standards Institute (ANSI), have effectively stated their positions regarding EC '92. In general, we concur with their observations.

The purpose of this statement is to express concerns that are, because of our industry's unique nature, specific to America's manufacturing technology industry. They fall into four areas:

1. Transparency or openness of standards writing procedures.
2. Testing and certification requirements.
3. Local content requirements.
4. Metrication of U.S. products.

II. TRANSPARENCY OR OPENNESS OF STANDARDS WRITING PROCEDURES

Basic differences between EC draft standards and ANSI standards reflect long-standing differences in the technical approach to achieving machine safety. U.S. machine tool manufacturers can comply with either approach, when the requirements are known.

However, because machine tools and other manufacturing machines generally require two or more years to redesign and produce, access to preliminary draft standards is essential for our industry's continued sales in the European market.

The first EC '92 machinery standards did not reach the preliminary review stage until May 1989, while others will not reach this stage until 1992. Given normal transmission delays from CEN or

CENELEC to ISO to ANSI to NMTBA, most of America's machine tool and manufacturing machinery builders will not learn what design changes are required until it is much too late to redesign and produce new machines for delivery in early 1993. The result will be U.S. absence from this vital market during its formative stage and a near-impossible task of re-entering the market after our European competitors are firmly established.

Therefore, it is imperative that we work closely with both CEN and CENELEC to receive early standards drafts and copies of committee minutes. We can then know what to expect and provide early design guidance to U.S. builders of manufacturing machinery. The prompt receipt of minutes and preliminary drafts, throughout the entire standards-writing process, is of significantly greater value than observer status.

III. TESTING AND CERTIFICATION REQUIREMENTS

It is clear that every machine tool factory will have to be tested and quality-certified before it can market in the European Community. In addition to this, there will be safety certification and/or testing requirements on certain machines. Yet there is no clear indication of how or where the testing and certification will be performed.

At the present time, various European laboratories are performing factory inspections and product tests for European companies. These inspectors appear to be overloaded with European certification demand and would be unable to certify non-European companies and products. This, coupled with the lack of information about procedures for non-European producer certification, is of great concern to machinery builders.

An adequate supply of European Community-approved inspectors must be located in the United States. Machine tool builders are normally small businesses; space is limited; machines are quite large; delay will keep valuable factory assembly space and working capital tied up -- needlessly reducing the manufacturer's production rate, causing missed delivery commitments and, ultimately, financial instability.

IV. LOCAL CONTENT REQUIREMENTS

The very small businesses which comprise three-fourths of the U.S. machine tool industry cannot operate a worldwide network of plants. (The median U.S. machine tool builder produces less than $5 million per year.) Any local content requirements will cause irreparable damage to the U.S. machine tool industry.

V. METRICATION OF U.S. PRODUCTS

Virtually every machine tool produced in the United States is capable of being operated as a metric machine. Dials, gages, readouts, etc., all read metric. (This situation is often called "soft metric.") Yet very few U.S.-produced manufacturing machines are built in metric dimensions, using metric components and parts (called "hard metric") because metric-size steel, spindles, etc. are not readily available in America. Hard or soft, the form of metrication makes no difference to the end product produced by the machine.

If the EC should demand "hard metric" machines, it is important that the EC make their intentions known, and known quickly, and that a substantial phase-in period for introducing new designs, in metric, be established. If the U.S. machine tool industry should be required to convert existing designs to metric, the cost would be unaffordable and our industry would have to withdraw from the European market.

VI. CONCLUSION

NMTBA appreciates this opportunity to express our views on the European Community's 1992 internal market initiative to the Committee. The suggestions put forth in this statement will ease the 1992 transition for American machine tool builders and many other manufacturers. They are necessary steps to ensure that the United States manufacturing technology industry continues to be a leading competitor in the global marketplace.

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UNDERWRITERS LABORATORIES INC.'S

STATEMENT ON

INTERNATIONAL STANDARDIZATION: THE FEDERAL ROLE

PRESENTED TO

THE SCIENCE, RESEARCH, AND TECHNOLOGY SUBCOMMITTEE

OF THE

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

JULY 25, 1989

BECAUSE OF UNDERWRITERS LABORATORIES' (UL) INVOLVEMENT AND INTEREST IN THE AREAS OF STANDARDS, TESTING, AND CERTIFICATION, BOTH IN THE U.S. AND INTERNATIONALLY, WE ARE PLEASED TO PRESENT OUR VIEWS ON THE ISSUE OF INTERNATIONAL STANDARDIZATION: THE FEDERAL ROLE.

IT SEEMS CLEAR THAT AN APPROPRIATELY COORDINATED STANDARDIZATION STRATEGY BETWEEN THE GOVERNMENT AND PRIVATE SECTORS HAS THE POTENTIAL TO PROVIDE SIGNIFICANT OPPORTUNITIES FOR U.S. MANUFACTURERS WHO WISH TO EXPORT THEIR PRODUCTS. HOWEVER, IN OUR ATTEMPTS TO ACHIEVE THE OPTIMUM SOLUTION, ALL THE PERTINENT ASPECTS OF THIS ISSUE MUST BE UNDERSTOOD AND CAREFULLY ANALYZED SO AS NOT TO EXPEND MISDIRECTED EFFORTS OR UNNECESSARILY DISTURB THE PROPERLY FUNCTIONING ASPECTS OF THE U.S. STANDARDIZATION SYSTEM.

UL BACKGROUND

BY THE WAY OF BACKGROUND, UL IS THE LARGEST PRIVATE PRODUCT SAFETY TESTING AND CERTIFICATION ORGANIZATION IN THE WORLD. LAST YEAR ALONE, MORE THAN SIX BILLION PRODUCTS WERE MANUFACTURED WITH THE UL LISTING MARK. WE INVESTIGATED PRODUCTS IN MORE THAN 12,500 CATEGORIES FOR OUR 38,000 CLIENT COMPANIES.

UL HAS DEVELOPED, IN COOPERATION WITH INDUSTRY AND THE U.S. SAFETY SYSTEM, WELL OVER 500 OF ITS OWN PRODUCT SAFETY STANDARDS. UL ALSO PARTICIPATES IN MORE THAN 500 STANDARDS COMMITTEES OF OTHER ORGANIZATIONS, INCLUDING MORE THAN 135 INTERNATIONAL STANDARDS COMMITTEES. FOR THE PAST SEVERAL YEARS, UL HAS BEEN OPERATING TECHNICAL ASSISTANCE TO EXPORTERS (TATE) AND TECHNICAL INFORMATION CENTER (TIC) PROGRAMS TO ASSIST AMERICAN MANUFACTURERS AND EXPORTERS WITH INTERNATIONAL AND FOREIGN NATIONAL SAFETY CERTIFICATION REQUIREMENTS, STANDARDS, AND PRACTICES.

OUR BRIEF STATEMENT FOR THE RECORD IS A SYNOPSIS OF THE KEY OBSERVATIONS AND RECOMMENDATIONS FROM UL'S PERSPECTIVE.

THE U.S. STANDARDIZATION SYSTEM

IN THE U.S., THE STANDARDIZATION EFFORT IS SHARED JOINTLY BY THE GOVERNMENT AND PRIVATE SECTORS. THE FEDERAL AGENCIES, SUCH AS DOD, GSA, EPA, ETC., SUPPLEMENTED BY NUMEROUS STATE AND LOCAL GOVERNMENTS, PROMULGATE TENS OF THOUSANDS OF STANDARDS PRIMARILY FOR PROCUREMENT OR REGULATORY PURPOSES. IN THE PRIVATE SECTOR, THERE ARE HUNDREDS OF ORGANIZATIONS THAT ARE INVOLVED IN STANDARDIZATION ACTIVITIES WITH MOST OF THEIR EFFORTS RESULTING IN VOLUNTARY PRODUCT STANDARDS.

THE OFFICIAL U.S. FEDERAL POLICY, ESTABLISHED BY THE OFFICE OF MANAGEMENT AND BUDGET VIA OMB CIRCULAR A-119, ENCOURAGES FEDERAL AGENCIES TO UTILIZE VOLUNTARY STANDARDS IN THEIR PROCUREMENT AND REGULATORY PROGRAMS TO THE MAXIMUM EXTENT FEASIBLE.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) FUNCTIONS AS A COORDINATOR OF DOMESTIC STANDARDS ACTIVITIES, AS WELL AS THE U.S. REPRESENTATIVE TO THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) AND THE INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC).

THE PRIVATE SECTOR VOLUNTARY SYSTEM HAS BEEN AND CONTINUES TO BE MARKET DRIVEN AND EFFECTIVE. THE INCREASE IN INTERNATIONAL STANDARDIZATION ACTIVITIES OF ANSI AND OTHER STANDARDS GROUPS IN RESPONSE TO THE RECENT EC 1992 INITIATIVES, AS WELL AS AN UPSWING IN INTERNATIONAL TRADE, VALIDATES THIS POINT. FOR ITS PART, UL, IN ADDITION TO HAVING INTERNATIONAL TESTING AND INSPECTION ACTIVITIES OF ITS OWN IN OVER 74 COUNTRIES, WORKS VERY CLOSELY WITH ANSI ON INTERNATIONAL STANDARDIZATION MATTERS. UL HAS BEEN A MEMBER OF ANSI FOR MANY YEARS AND OUR STAFF MEMBERS SERVE ON NUMEROUS ANSI COMMITTEES, BOARDS, AND COUNCILS. IT IS UL POLICY TO SUBMIT ITS SAFETY STANDARDS TO ANSI FOR APPROVAL AS AMERICAN NATIONAL STANDARDS.

INDUSTRY INFLUENCE ON U.S. INTERNATIONAL STANDARDS PARTICIPATION

UL DEALS DIRECTLY WITH HUNDREDS OF INDUSTRY SECTORS VIA OUR 230 INDUSTRY ADVISORY CONFERENCES AND OTHER FORUMS. U.S. INDUSTRY ITSELF SIGNIFICANTLY INFLUENCES THE LEVEL OF U.S. PARTICIPATION IN INTERNATIONAL STANDARDIZATION ACTIVITIES. THE U.S. MANUFACTURERS, RESPONDING TO AN ECONOMIC OPPORTUNITY AND ACTING EITHER INDIVIDUALLY OR JOINTLY WITH OTHER COMPANIES REPRESENTING A CERTAIN INDUSTRY, DETERMINE THE LEVEL OF INTEREST AND RESOURCE COMMITMENT WHICH, IN TURN, IS REFLECTED IN U.S. PARTICIPATION IN ISO AND IEC COMMITTEES, SUBCOMMITTEES, AND WORKING GROUPS THROUGH ANSI COORDINATION. FOR EXAMPLE, IN INTERNATIONAL COMMITTEES INVOLVED IN AREAS OF SIGNIFICANT

ECONOMIC IMPORTANCE TO THE U.S. INDUSTRY, MORE SECRETARIATS ARE HELD BY THE U.S. THAN ANY OTHER NATION IN THE WORLD.

THOSE COMPANIES THAT ARE INVOLVED IN INTERNATIONAL TRADE RECOGNIZE THAT INTERNATIONAL STANDARDS HARMONIZATION AND FAIRLY IMPLEMENTED ACCEPTANCE CRITERIA CAN LESSEN THE PRESSURES FOR PROTECTIONISM AND PROVIDE ACCESS TO FREER INTERNATIONAL TRADE. HOWEVER, WITHIN THE U.S., THE NUMBER OF INTERNATIONAL STANDARDS THAT ARE USED LOCALLY ARE FAR LESS THAN THOSE USED IN OTHER NATIONS, ESPECIALLY THE EC AND THIRD WORLD COUNTRIES. THEREFORE, TO DATE, U.S. COMPANIES HAVE EXPRESSED A RELATIVELY LOW LEVEL OF INTEREST IN GETTING INVOLVED IN INTERNATIONAL STANDARDIZATION FORUMS.

BALANCE OF ROLES IN THE U.S. SYSTEM

THE U.S. STANDARDIZATION SYSTEM IS DELICATELY BALANCED WITH KEY ROLES BEING PLAYED BY GOVERNMENTAL AGENCIES, PRIVATE SECTOR ENTITIES, JURISDICTIONAL AUTHORITIES, AND CONSUMER INTERESTS. THE DELICATE NATURE OF THE SYSTEM IS FURTHER ENHANCED BY THE IMPORTANT ISSUES OF STATES' RIGHTS AND LEGAL ASPECTS, ESPECIALLY THOSE PERTAINING TO PRODUCTS LIABILITY LAWS.

ALSO, THE AUTHORITIES AS WELL AS RESPONSIBILITIES ARE BALANCED BETWEEN GOVERNMENTAL AND PRIVATE SECTORS. THE PRIVATE SECTOR STRUCTURE PERMITS HIGH QUALITY STANDARDS TO BE DEVELOPED FOR A WIDE VARIETY OF ACTIVITIES IN A RELATIVELY SHORT PERIOD OF TIME, AT NO COST TO THE FEDERAL GOVERNMENT AND WHERE THE CONCERNS OF ALL INVOLVED PARTIES ARE HEARD AND CONSIDERED.

MOREOVER, THIS SYSTEM PERMITS INTRODUCTION OF NEW AND INNOVATIVE PRODUCTS INTO COMMERCE BY PROVIDING A HIGH DEGREE OF FLEXIBILITY IN STANDARDS DEVELOPMENT AND CONTENT, AS WELL AS PERMITTING RAPID REVISIONS OF THESE DOCUMENTS, IN MOST CASES. THE GOVERNMENT ADOPTION OF THOUSANDS OF PRIVATE SECTOR STANDARDS IS A TESTIMONIAL TO THE QUALITY AND EFFECTIVENESS OF OUR PRIVATE SECTOR STANDARDIZATION SYSTEM. THIS ACTION, HOWEVER, DOES CONVERT VOLUNTARY STANDARDS INTO DE FACTO MANDATORY STANDARDS WHICH, IN TURN, ARE USED TO DISPENSE GOVERNMENTAL AUTHORITY IN THE AREAS OF SAFETY REGULATIONS OR PROCUREMENT. FOR THE MOST PART, THE U.S. SYSTEM IS EFFICIENT, FLEXIBLE, ACCESSIBLE, AND, PERHAPS MOST SIGNIFICANTLY, IT WORKS. FOR THIS REASON ALONE, IT SHOULD NOT BE DISTURBED SOLELY TO CREATE A GREATER DEGREE OF INTERNATIONAL INVOLVEMENT BY THE GOVERNMENT SECTOR.

COMPARISON OF THE U.S. SYSTEM WITH THE SYSTEMS OF OTHER COUNTRIES

IT HAS BEEN STATED THAT THE GOVERNMENTS OF MOST INDUSTRIALIZED COUNTRIES HAVE A STRONGER INVOLVEMENT IN THE INTERNATIONAL STANDARDIZATION ARENA IN COMPARISON TO THE U.S. HOWEVER, IT IS IMPORTANT TO NOTE THAT OTHER GOVERNMENTS ALSO HAVE A STRONG INVOLVEMENT IN THE NATIONAL STANDARDS SYSTEMS AS WELL. AS INDICATED EARLIER, THIS IS NOT THE CASE IN THE U.S. PERHAPS A GREATER RELIANCE ON INTERNATIONAL TRADE AND EXPORT ACTIVITY BY THESE NATIONS ALSO EXPLAINS THEIR GREATER COMMITMENT TO INTERNATIONAL STANDARDIZATION EFFORTS. FURTHERMORE, IN MANY

EXPORT ORIENTED COUNTRIES, SUCH AS JAPAN, GERMANY, TAIWAN, ETC., THERE ARE RELATIONSHIPS BETWEEN THE GOVERNMENT AND COMMERCIAL SECTORS THAT ARE AIMED AT CHANNELING COLLECTIVE RESOURCES TOWARD A SINGLE-MINDED OBJECTIVE TO EXPORT PRODUCTS. IN MOST CASES, THESE NATIONS OPERATE WITHOUT SOME OF THE LIMITATIONS ASSOCIATED WITH THE U.S. SYSTEM, SUCH AS AN OPEN AND TRANSPARENT STANDARDIZATION PROCESS, CONSIDERATION OF CONCERNS OF MANY GROUPS, ANTITRUST LAWS, ETC.

U.S. ACCESS TO FOREIGN MARKETS

CLEARLY, THE ABILITY OF U.S. MANUFACTURERS TO GAIN EQUAL AND COMPETITIVE ACCESS TO FOREIGN MARKETS SHOULD BE A DRIVING FORCE BEHIND ALL THE DELIBERATIONS INVOLVING OUR PARTICIPATION IN THE INTERNATIONAL STANDARDIZATION ACTIVITIES AND THE ROLE OF FEDERAL GOVERNMENT IN THAT EFFORT. BROADER ACCEPTANCE OF EC DEVELOPED STANDARDS CAN BE EXPECTED TO POSE INCREASED COMPETITION FOR U.S. GOODS IN BOTH THE EC AND THIRD WORLD COUNTRIES.

MOREOVER, EC STANDARDS HARMONIZATION ULTIMATELY HOLDS IMPLICATIONS FOR ACCEPTABILITY IN THIRD WORLD MARKETS OF PRODUCTS MADE TO AMERICAN STANDARDS. WHEREVER POSSIBLE, IT CAN BE EXPECTED THAT THE EC WILL DEVELOP EUROPEAN STANDARDS VIA CEN/CENELEC TO TRACK INTERNATIONAL STANDARDS DEVELOPED BY ISO AND IEC TO THE GREATEST EXTENT POSSIBLE. THE PROBLEM MAY ARISE WHERE U.S. STANDARDS DO NOT CONFORM TO INTERNATIONAL STANDARDS. THIS COULD REQUIRE U.S. MANUFACTURERS TO DEVELOP A SECOND LINE

OF PRODUCTS SPECIFICALLY DESIGNED FOR EXPORT. THIS, IN TURN, COULD LEAD TO EXTRA COST OF PRODUCTION MODIFICATIONS, THUS LEAVING U.S. PRODUCTS LESS COMPETITIVE IN THE WORLD MARKETS.

CLEARLY, THERE IS A NEED FOR U.S. COMPANIES TO STAY COMPETITIVE ON THE INTERNATIONAL SCENE. IT IS COST-EFFECTIVE FOR THESE COMPANIES TO BE ABLE TO SELL PRODUCTS THAT ARE SIMILAR TO PRODUCTS THAT ARE MADE FOR U.S. CONSUMPTION. THUS, IT IS IN THE BEST INTEREST OF THE U.S. TO IMPROVE AND ENHANCE ITS PARTICIPATION IN ISO AND IEC COMMITTEE ACTIVITIES, SINCE THIS IS LIKELY TO BE THE ONLY PATH TO GET INPUT INTO THE CEN/CENELEC STANDARDS DEVELOPMENT PROCESS.

IN INDUSTRY SECTORS WHERE THE U.S. MANUFACTURERS HAVE AN INTEREST IN EXPORTING, OR WHERE THE U.S. HOLD TECHNOLOGICAL ADVANTAGES, THE U.S. STRATEGY SHOULD BE TO ATTEMPT TO CAUSE THE INTERNATIONAL STANDARDIZATION ACTIVITY TO BE ORIENTED TOWARDS THE U.S. STANDARDS DEVELOPMENT PROCESS. AS STATED EARLIER, THE RESOURCE COMMITMENT AND MANPOWER SUPPORT HAVE BEEN PUT FORTH IN THE PAST FROM U.S. MANUFACTURERS, PARTICULARLY IN INDUSTRY SECTORS WHERE THERE WAS PERCEIVED TO BE AN INTEREST AND/OR A NEED TO EXPORT PRODUCTS.

THE LONG TERM IMPACT OF NOT GETTING INVOLVED WHILE OTHER NATIONS ELECT TO PARTICIPATE IN INTERNATIONAL STANDARDIZATION COULD BE CRUCIAL TO THE CONTINUATION OF BUSINESS OPPORTUNITIES OF U.S. COMPANIES FOR MANY YEARS TO COME. THEREFORE, IN AREAS WHERE THERE IS NO DESIRE BY THE PRIVATE

SECTOR TO COMMIT RESOURCES, EITHER DUE TO SHORT TERM INTERESTS OR OTHER REASONS, AND YET A SOCIETAL OR NATIONAL NEED CLEARLY EXISTS FOR A U.S. ROLE IN INTERNATIONAL STANDARDIZATION, IT WOULD BE APPROPRIATE TO DEVELOP SCENARIOS FOR FEDERAL AGENCY FUNDING, SUPPORT, OR COOPERATIVE EFFORT. THIS COULD BE ACCOMPLISHED VIA CONGRESSIONAL DIRECTIVES TO PROVIDE GRANTS, GOVERNMENT FUNDING, MANPOWER ASSISTANCE, ETC. TO CARRY OUT THE NEEDED ACTIVITIES IN COOPERATION WITH THE PRIVATE SECTOR. THE SPECIFIC PROGRAMS, OF COURSE, SHOULD BE DEVELOPED WITH INDUSTRY'S KNOWLEDGE, INVOLVEMENT, AND CONSENT.

ALTERNATIVE APPROACHES

IN ORDER TO BE EFFECTIVE, GOVERNMENT ASSISTANCE TO VOLUNTARY STANDARDS EFFORTS IN THE INTERNATIONAL ARENA AIMED AT BOOSTING U.S. EXPORTS SHOULD BE CARRIED OUT LOGICALLY AND SYSTEMATICALLY. SOME OF THE KEY QUESTIONS THAT MUST BE ANSWERED ARE: WHICH INDUSTRY SECTOR WILL BE SUPPORTED? WHAT CRITERIA WILL BE USED? WHAT WILL BE THE IMPACT ON COMPETING INDUSTRIES? ASSISTANCE AIMED AT ENHANCING EXPORTS TO WHAT COUNTRIES WOULD TAKE PRIORITIES?

STANDARDIZATION ASSISTANCE OR INTERNATIONAL STANDARDIZATION ACTIVITIES ARE ONE OF THE MANY CONTRIBUTING ELEMENTS TO ENHANCED EXPORTS. TO UNILATERALLY INCREASE THE FEDERAL ROLE IN THE AREA OF INTERNATIONAL STANDARDIZATION WITHOUT ESTABLISHING THE BENEFITS OF SUCH EFFORTS WOULD BE IRRESPONSIBLE, PARTICULARLY IN THE FACE OF FEDERAL BUDGETARY

RESTRAINTS. ALSO, WITHOUT PROVING THAT DIRECT GAINS IN U.S. EXPORTS WILL OCCUR, ASSISTANCE TO FOREIGN STANDARDS GROUPS IN OTHER COUNTRIES WOULD AMOUNT TO SUPPORT OF THESE OVERSEAS STANDARDS DEVELOPMENTAL ACTIVITIES WHILE NO CORRESPONDING SUPPORT IS BEING PROVIDED TO U.S. DEVELOPING, AILING, OR CHANGING INDUSTRIES THAT ARE STRUGGLING UNDER THE IMPACT OF IMPORTS.

THEREFORE, IN DEVELOPING THE U.S. STRATEGY, CONSIDERABLE EFFORT SHOULD BE EXPENDED TO BETTER INFORM THE VARIOUS U.S. INDUSTRIES REGARDING THE EXISTING OR DEVELOPING BUSINESS OPPORTUNITIES IN FOREIGN MARKETS, THE LONG TERM CONSEQUENCES OF LEAVING THOSE MARKETS UNATTENDED, AND THE OVERALL IMPACT OF U.S. INACTIVITY ON INTERNATIONAL TRADE AND OUR ECONOMIC WELL-BEING.

ALSO, SPECIFIC ENCOURAGEMENT SHOULD BE PUT FORTH TO DEVELOPING AND NEWLY INDUSTRIALIZED COUNTRIES TO ADOPT INTERNATIONAL STANDARDS. THIS WILL FACILITATE INTERNATIONAL TRADE AND REDUCE U.S. COSTS FOR THE UNILATERAL DEVELOPMENT OF INTERNATIONAL OR FOREIGN NATIONAL STANDARDS.

WHERE THE U.S. PRIVATE SECTOR SYSTEM FAILS TO RECOGNIZE AND/OR SUPPORT THE AGREED UPON AND PROPERLY DOCUMENTED NATIONAL NEEDS, COOPERATIVE PRIVATE/PUBLIC SECTOR INITIATIVES SHOULD BE ESTABLISHED.

A REASONABLE COMPROMISE SOLUTION COULD BE TO ENCOURAGE A LARGER COMMITMENT FROM U.S. COMPANIES BY MAKING AVAILABLE MATCHING FUNDS FROM U.S. GOVERNMENT. SOME FORMULA COULD BE DEVELOPED, USING THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) OR SOME OTHER OFFICIAL ENTITY, TO MATCH THE VOLUNTARY SECTOR RESOURCE COMMITMENT IN SPECIFIC EXPORT ORIENTED INTERNATIONAL STANDARDIZATION ACTIVITIES OF INTERESTED INDUSTRY GROUPS. ANSI COULD BE USED AS THE COORDINATING NATIONAL BODY. THIS APPROACH WILL ASSURE THAT RESOURCES WILL BE EXPENDED ONLY IN THOSE AREAS WHERE AN INDUSTRY GROUP HAS DETERMINED, AFTER CAREFUL ANALYSIS, THAT EXPORT OPPORTUNITIES EXIST TO WHICH MEASURED RESOURCES CAN BE COMMITTED.

IMPEDIMENTS TO U.S. EXPORTS

IN ADDITION TO STANDARDIZATION, MANY OTHER FACTORS AFFECT INTERNATIONAL TRADE. SOME ARE: LOCAL CONTENT RULES, ESTABLISHED NATIONAL DISTRIBUTION SYSTEMS, PREFERENCE FOR NATIONAL PRODUCTS, AVAILABILITY OF COMPONENTS AND RAW MATERIALS, INTEREST OF EXPORTERS, GOVERNMENT REGULATIONS, AND PRODUCT APPROVAL MECHANISMS.

ALTHOUGH THE U.S. NATIONAL FOCUS SEEMS TO BE ON THE STANDARDS, THE PREDOMINANT MECHANISMS USED TO IMPLEMENT STANDARDS AND STANDARDS POLICY ARE THE PRODUCT TESTING AND CERTIFICATION PROCESSES. IF THE OBJECTIVE IS TO LOOK AT THE IMPACT ON THE OVERALL U.S. EXPORT EFFORT, WE CANNOT ADDRESS THE STANDARDS ISSUE WITHOUT CONSIDERING THESE MECHANISMS. TESTING

AND CERTIFICATION MECHANISMS ALONG WITH STANDARDS, CAN BE AND FREQUENTLY ARE USED AS NONTARIFF BARRIERS TO TRADE. A RECENT U.S. CHAMBER OF COMMERCE REPORT DESCRIBES THESE AS THE ACHILLES' HEEL IN THE STANDARDS HARMONIZATION PROCESS. THEREFORE, IT IS SAFE TO SPECULATE THAT U.S. EXPORTERS TO EUROPE AND OTHER NATIONS COULD FIND THEMSELVES DISADVANTAGED VIA THESE ROUTES.

THE PRACTICAL, IMPLEMENTING ASPECTS OF PRODUCT STANDARDS REVOLVE AROUND LABORATORY TESTING AND CERTIFICATION OF TEST RESULTS. THIS PHASE OF THE PROCESS RAISES MANY QUESTIONS FOR AMERICAN PRODUCERS THAT INTEND TO EXPORT PRODUCTS. THERE ARE MANY WAYS OF CERTIFYING THE CONFORMITY OF A PRODUCT WITH THE REQUIREMENTS OF THE APPLICABLE STANDARD(S), RANGING FROM SIMPLE TO COMPLEX. SOME OF THESE METHODS CAN EFFECTIVELY PREVENT PRODUCTS FROM BEING IMPORTED INTO A COUNTRY. CONSIDER THE FOLLOWING: RULES MANDATING CERTIFICATION WITHIN NATIONAL BOUNDARIES BY NATIONAL APPROVAL SCHEMES AND BODIES, THE USE OF LOCAL CONTENT REQUIREMENTS, IMPORT INSPECTION REQUIREMENTS, AND FOREIGN FACTORY INSPECTION BY NATIVE AUTHORITIES.

THUS, A PRIMARY U.S. STRATEGY OUGHT TO BE TO ACHIEVE THE OBJECTIVES OF FAIR TRADE VIA EQUAL AND COMPETITIVE ACCESS TO FOREIGN MARKETS BY U.S. MANUFACTURERS. THE FOLLOWING REPRESENTS CERTAIN KEY INITIATIVES THAT CAN BE USED AS PART OF THE U.S. STRATEGY:

(1) EQUAL AND COMPETITIVE ACCESS TO INTERNATIONAL AND FOREIGN NATIONAL TESTING AND CERTIFICATION PROGRAMS FOR U.S. MANUFACTURERS.

(2) PRODUCT CATEGORY AND STANDARDS SPECIFIC TEST DATA EXCHANGE PROCEDURES AND BILATERAL ARRANGEMENTS RATHER THAN GENERIC ACCREDITATION AND ACCEPTANCE SCHEMES.

(3) U.S. HARMONIZATION OF ITS STANDARDS WITH INTERNATIONAL STANDARDS TO THE EXTENT PRACTICABLE, IF REQUESTED BY AN INDUSTRY.

(4) RECOGNITION OF THE FACT THAT IT IS NOT NECESSARY, AND PROBABLY NOT PRACTICAL, TO HAVE IDENTICAL STANDARDS, TESTING, AND CERTIFICATION SYSTEMS IN ALL NATIONS, BUT RATHER THE IMPORTED PRODUCTS SHOULD BE AFFORDED ACCESS TO CONFORMITY ASSESSMENT PROCEDURES EQUIVALENT TO THOSE ENJOYED BY THE DOMESTIC PRODUCERS AS WELL AS OTHER EXPORTERS. THIS IS SIGNIFICANT BECAUSE IT ACCOMPLISHES THE OBJECTIVE OF ADVANCING FAIR AND EQUAL TREATMENT OF EXPORTS BUT DOES NOT JEOPARDIZE THE SAFETY LEVELS REQUIRED NOR THE ADMINISTRATIVE AND LEGAL REQUIREMENTS OF EACH INDIVIDUAL COUNTRY.

(5) DEVELOPMENT OF BILATERAL AGREEMENTS BASED ON METHODICAL AND LOGICAL PROCEDURES TO ENSURE UNIFORMITY OF TEST RESULTS AND PRODUCT EVALUATIONS, RESULTING IN THOSE APPROVALS WHICH WILL RECEIVE ACCEPTANCE BY AUTHORITIES AT ALL LEVELS OF THE LOCAL GOVERNMENT.

UL PROGRAMS TO ASSIST U.S. EXPORTERS

UL ALWAYS HAS AND WILL CONTINUE TO DEVELOP SAFETY STANDARDS, TESTING, AND CERTIFICATION PROGRAMS WHICH RESPOND TO LEGITIMATE INTERESTS AND NEEDS OF NOT ONLY THE INDUSTRY BUT ALSO THE FEDERAL, STATE, AND LOCAL GOVERNMENT AGENCIES. IN THE AREA OF INTERNATIONAL TRADE SPECIFICALLY, UL HAS BEEN COGNIZANT OF THE RESPONSIBILITY TO ASSIST U.S. MANUFACTURERS IN THEIR EFFORTS TO EXPORT PRODUCTS TO OTHER NATIONS.

UL'S TATE AND TIC PROGRAMS WERE ESTABLISHED TO PROVIDE ASSISTANCE TO U.S. EXPORTERS IN MEETING THE COMPLEX REQUIREMENTS IN FOREIGN COUNTRIES. WITHIN UL'S STANDARDS DEVELOPMENT PROCESS, SPECIFIC REQUESTS BY U.S. INDUSTRIES TO HARMONIZE UL SAFETY STANDARDS WITH THE APPROPRIATE INTERNATIONAL STANDARDS HAVE BEEN ACTED UPON.

UL HAS DEVELOPED RECIPROCAL AGREEMENTS WITH QUALIFIED FOREIGN LABORATORIES, STANDARDS GROUPS, AND APPROVAL BODIES UNDER CONTROLLED CONDITIONS INVOLVING EVALUATION OF QUALIFICATIONS, TESTING, FACTORY INSPECTIONS, AND APPROVAL PROCESSES WHERE SUCH AGREEMENTS WERE DEEMED TO BE OF SOME BENEFIT TO U.S. MANUFACTURERS OR WHERE INTERNATIONAL TRADE AND/OR STANDARDS HARMONIZATION WERE PROMOTED. HOWEVER, IT IS UL'S POLICY THAT, IN THE PURSUIT OF THE HARMONIZATION IN INTERNATIONAL STANDARDS, A CLEAR DISTINCTION WILL BE MADE BETWEEN SEEKING HARMONIZATION SOLELY FOR THE SAKE OF HARMONIZATION AND THE NEED FOR A STRONG CONSENSUS ON THE PART OF THE INVOLVED INDUSTRY(S) AND OTHER USERS THAT SUCH HARMONIZATION IS ACTUALLY NEEDED.

SPECIFICALLY, THE UL PROGRAMS THAT ARE PRESENTLY AVAILABLE TO HELP U.S. MANUFACTURERS IN EXPORTING TO OTHER NATIONS ARE:

(1) LETTER REPORTS COVERING SPECIFIED REQUIREMENTS.

(2) CLASSIFICATION TO IDENTIFIED INTERNATIONAL OR FOREIGN NATIONAL REQUIREMENTS.

(3) BILATERAL AGREEMENTS FOR SPECIFIED PRODUCTS AND STANDARDS.

(4) PARTICIPATION IN INTERNATIONAL CB SCHEME.

(5) PARTICIPATION IN ISO AND IEC ACTIVITIES TO REPRESENT THE U.S. VIEWS AND/OR BRING ABOUT APPROPRIATE HARMONIZATION OF UL SAFETY STANDARDS, WHERE SUCH ACTIONS ARE LIKELY TO BE OF BENEFIT TO THE INVOLVED INDUSTRY, PUBLIC SAFETY, AND INCREASE UTILIZATION OF SAFETY CERTIFICATION PROGRAMS.

(6) MAKE AVAILABLE INFORMATION ABOUT PRODUCTS AND COMPONENTS EVALUATED TO IEC OR ISO PUBLICATIONS.

(7) PROVIDE INCREASED EXPOSURE TO COMPANIES THAT HAVE PRODUCTS EVALUATED TO INTERNATIONAL REQUIREMENTS VIA PUBLICATION OF THEIR NAME IN UL'S INTERNATIONAL PRODUCT DIRECTORY.

(8) ESTABLISHMENT OF LOCAL UL CENTERS IN FOREIGN COUNTRIES TO PROVIDE ASSISTANCE.

CONCLUSION

IT IS RECOMMENDED THAT A SPECIFIC STRATEGY SHOULD BE DEVELOPED FOR A STRONG U.S. INVOLVEMENT IN INTERNATIONAL STANDARDIZATION. THIS STRATEGY MUST INCLUDE CONSIDERATIONS RELATING TO TESTING AND CERTIFICATION MECHANISMS. IT WOULD BE COUNTERPRODUCTIVE TO BASE A U.S. STRATEGY SOLELY ON STANDARDIZATION BECAUSE FOREIGN NATIONS COULD IMPEDE THE FLOW OF U.S. PRODUCTS BY USING UNFAIR ASSESSMENT PROCEDURES, EVEN THOUGH THESE PRODUCTS MAY COMPLY WITH THE APPLICABLE STANDARDS.

ACCESS TO FOREIGN MARKETS IS THE PRIMARY ISSUE VIA ASSESSMENT PROCEDURES, TESTING, AND CERTIFICATION, AND NOT SOLELY THE COMPLIANCE WITH A STANDARD. IF AN ECONOMICALLY DESIRABLE MARKET EXISTS AND CAN BE REACHED, U.S. MANUFACTURERS CAN USUALLY MAKE THE NECESSARY PRODUCT CHANGES TO COMPLY WITH THE INTERNATIONAL OR FOREIGN NATION STANDARD. BUT, THEY CAN ONLY SELL IF THE MARKET IS OPEN TO THEM.

THE MANY DIVERSE U.S. STANDARDS ORGANIZATIONS MUST EXPLORE WAYS TO ACHIEVE CLOSER COORDINATION AND EFFECTIVE COLLECTIVE ACTION, PROBABLY UNDER THE AUSPICES OF AN UMBRELLA ORGANIZATION, SUCH AS ANSI. THE PRIVATE SECTOR MUST CONTINUE TO WORK CLOSELY WITH THE FEDERAL AGENCIES TO ASSIST IN THE IMPORTANT TASK OF REPRESENTING U.S. INTERESTS IN INTERNATIONAL STANDARDIZATION, AS WELL AS ACHIEVING THE PRIMARY OF OBJECTIVE FAIR TRADE AND EQUAL COMPETITIVE ACCESS TO FOREIGN MARKETS FOR U.S. PRODUCTS.

QUESTIONS AND RESPONSES TO METRIC QUESTIONS

RESPONSE FROM RAYMOND KAMMER, ACTING DIRECTOR, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, GAITHERSBURG, MD. TO ADDITIONAL QUESTIONS CONCERNING METRICATION

RESPONSE TO CONGRESSMAN BROWN'S QUESTIONS

QUESTION 1

I don't believe any of you would disagree that the SI metric system is perhaps one of the best examples of an international standard. Would (you) explain to me why your organization(s) have been so reluctant to be more active in support of the U.S. adoption of metric?

REPLY

We recognize that the metric system is a fundamental international standard. Metric is used naturally and extensively throughout NIST in technical and scientific work, as it is in private sector science and in certain sectors of private industry. Following passage of the Metric Conversion Act of 1975, federal leadership for voluntary conversion to U.S. use of metric was provided by the U.S. Metric Board. NIST supported that leadership, as well as that of the Office of Metric Programs within the Department of Commerce, which took up the functions of the Board. Since passage of the 1988 Trade Act, there is clearly an expanded mandate for federal metric leadership, particularly with respect to U.S. industry. NIST fully supports the new metrication initiatives within the Department of Commerce established by its Departmental Administrative Order No. 201-21 of July 6, 1989.

QUESTION 2

If you agree that SI metric is an international standard, and you all promote U.S. involvement in international standards, I fail to see how you could so obviously leave the metric issue out of the agendas of your national meetings. I have looked at those periodicals and agendas, including those in 1987 and 1988, and found little or no coverage of the U.S. industrial metrification issue. How can you explain that? And what are you going to do about it in the future?

REPLY

The use of the SI units and the metric system in general has never waned in our technical and scientific work. Employment of the SI units is an intrinsic and natural process in our everyday work. There is no basis for singling out the use of metric units as an issue. Within the scientific community it is not an issue.

Absence of the metrication issue, as such, in the agendas of our meetings on technical standards does not reflect any lack of support for industrial metrication. In our meetings involving industries or companies that use or might be changing to metric, technical discussions and specifications naturally employ the metric system.

QUESTION 3

"I know that NIST is an active participant in the National Conference on Weights and Measures. I assume international standards were discussed at the most recent meeting in Seattle. How did NIST representatives deal with the metric question? Was it raised by them? If not, why not?"

REPLY

NIST Leadership Role. The NIST provides the Executive Secretariat for the National Conference on Weights and Measures and, consequently, influences the development of its program. The NIST Office of Weights and Measures provides technical support to the Conference committees and assists in their activities. The work in international standards is coordinated by the NIST Office of Standards Management.

At the most recent NCWM meeting in Seattle, several sessions dealt with the long term issue of introducing metric units into commercial and regulatory standards as well as the more recent aspects of the Omnibus Trade and Competitiveness Act. The Executive and Liaison Committees both addressed the Act including the requirements affecting Federal procurement in metric units.

Packaging and Labeling. The Conference has been dedicated to metric usage for over a decade. New standards, as developed, provide for use of metric units (note that most packages found on the shelves in the super markets have dual labeling). In fact, the NCWM has repeatedly requested through the FDA (the lead agency) that the Federal Fair Packaging and Labeling Act be modified to permit "metric-only" labeling. The NCWM remains frustrated in this regard. State regulations must conform to the Federal regulation in this case. In the meantime, NIST Handbook 133, "Checking the Net Contents of Packaged Goods" provides standards in customary and metric units.

Commercial Devices. Scales and meters (especially gas dispensers) are being manufactured and sold with "built-in" capabilities to compute in metric units. These devices are designed to the standards provided in NIST Handbook 44. For several years, annual changes in the Handbook have included standards in customary units (still required by regulation) and metric units. Changeover thereby becomes rather easy (i.e., selling gasoline by the liter rather than by the gallon).

The Omnibus Trade Act. Ray Kammer was the keynote speaker at the opening General Session. In his address, he described the highlights of the Omnibus Trade and Competitiveness Act, noting the role of NIST in providing the measurement standards necessary for its implementation.

Metric Information. The Metric Office of the Department of Commerce provided metric materials for a table at the registration area for use by the conferees.

Liaison Committee. The Liaison Committee was the focal point for specifically addressing the metric issues. The report of the Committee contained the following.

"The Committee will work with the United States Metric Association (USMA), the American National Metric Council, and the U.S. Metric Office of the U.S. Department of Commerce to increase awareness by weights and measures officials of the 1988 amendment to the Metric Conversion Act. Mr. Louis Sokol, representing the United States Metric Association, and Mr. Ted Wright, representing the American National Metric Council, gave remarks and distributed metric literature. The National Metric Conference, sponsored by these organizations and the U.S. Department of Commerce, will be held at the Sheraton Hotel in Arlington, VA on October 2-3, 1989.

"The Department of Commerce (DOC) Metric Program Office's role in the metric transition was discussed. In keeping with the intent of the Metric Conversion Act of 1975, as amended by the 1988 Trade Act, the Commerce Metric Program focuses on creating a favorable environment for the change. The mission includes elements which:

- coordinate Federal metric transition to promote consistency in agency plans, policies, and practices. This is done through formal and comprehensive inter-agency committees;

- identify and help remove barriers that inhibit or block metric transition in Federal, State or local rules, standards and codes, or regulations;

- bring together representatives from public and private sectors to resolve problems and share information;

- help U.S. businesses to identify metric requirements in overseas markets;

- provide technical and general information about the metric system and its use to businesses, educators, the news media, and the general public; and

- assist the states and local governments in their efforts to facilitate the metric transition.

"The DOC Metric Program Office asks the weights and measures community, and the NCWM in particular, to take an active role in supporting the metric transition process and make their offices and staff resources available to assist public and private sector organizations and individuals in their State.

"The DOC Metric Program Office asks NCWM members to maintain close contact with other State agencies and with their Governors' representatives on the National Council on State Metrication (NCSM).

"The DOC Metric Program Office invites the NCWM members to refer questions about Federal metric usage directly to the Federal agency involved, to its metric coordinator, or to the Metric Programs staff of the U.S. Department of Commerce, Technology Administration, as appropriate.

"Copies of the letters sent to Federal agencies, a Brief History of the Measurement System Office of Metric Programs Fact Sheet, and the Metric Conversion Act of 1975 and the 1988 Amendment were distributed. The information and a handbook of Federal officials can be obtained from the Department of Commerce Metric Program Office, Washington, DC, telephone (202) 377-3036.

"The Office of the NIST Associate Director for Industry and Standards requested that the Committee review the European Community Directives and Amendments of 1974-1988 mandating certain metric sizes for wine, beer, distilled spirits, juices, edible oils, vinegar and sparkling waters. The Committee contacted various industry trade associations: Bureau of Alcohol, Tobacco, and Firearms (BATF), DOC's Office of European Affairs, Department of Defense, and NCWM's Industry Committee on Packaging and Labeling.

"The Committee recommends that the Executive Committee approve the formation of an educational forum concerning the European Community activities and how these activities can affect the interest of the NCWM and its industry members who import and export products."

International Standards. International standards are always an important subject at the meetings of the National Conference. The Chairman of the NCWM regularly appoints NCWM participants to the OIML working groups. This involvement is necessary in order to insure that the standards being developed in the U.S. and the international marketplace are compatible. In recent years, the NCWM adopted an entire new "code of standards" for scales used in commerce. The new "Scales Code" incorporates the key elements of the international standards.

QUESTION 4.

It is my understanding that Secretary of Commerce Mosbacher is vitally interested in standards. In that regard, he recently sent a memorandum to all federal agencies requesting their support of the metric legislation enacted last August 23rd. Does NIST intend to fully support this legislation by naming an Assistant Secretary to the Interagency Committee on Metric Policy (ICMP) as requested?

As a Commerce Department component, NIST itself is not a member of the Interagency Committee on Metric Policy (ICMP). The Under Secretary for Technology is the ICMP representative for the Department. However, NIST strongly supports the new emphasis placed by the Congress on U.S. industrial metrication and will be deeply involved in the work of the ICMP through NIST participation in the work of the various subcommittees of the Metrication Operating Committee on the ICMP.

ASTM
From the Office Of The President

September 27, 1989

Ms. Carol Pompliano
SRT Subcommittee
2319 RHOB
Washington, DC 20515

Dear Ms. Pompliano,

Thank you for the opportunity to respond to questions of Congressman Brown in regard to metrication.

We look forward to further interactions on this important issue.

Sincerely,

James Thomas
James A. Thomas
Executive Vice President

JAT/mah

Enclosure

ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103 (215) 299-5400 · TWX: 710-670-1037/ASTM PHA

Question 1

ASTM is a non-profit organization and as such, is not a public activist on the metric question, or on any other for that matter. However, since 1964, ASTM has required that all ASTM publications contain at a minimum the metric equivalent to the U.S. customary units. We have also provided for the promulgation of metric unit standards to compliment or replace U.S. customary unit versions.

The Society has established no mandatory conversion time schedule but has left the timing issue to each technical committee. Our Form and Style Manual contains very specific instructions on this issue and a copy is attached for your review.

Question 2

Again, ASTM does not choose metrication over, say, nuclear waste, as an issue to take a stand for or against. It must be understood that we are a voluntary, full consensus organization. That means that we embody and serve all points of view. Following the general consensus of our members, ASTM has published a globally recognized SI system standard E380 (copy attached). This standard serves to guide ASTM committees in the proper use of the SI system. In addition, we are currently working closely with NIST and AMMC representatives to increase the awareness of our constituency in the important area of metrication.

Form and Style for ASTM Standards

ASTM 7th Edition
March 1986

Form and Style for ASTM Standards

7th Edition • March 1986 — ASTM

FORM AND STYLE FOR ASTM STANDARDS

Form of ASTM Test Methods
Form of ASTM Specifications
Form of Other Types of ASTM Standards
Use of the Modified Decimal Numbering System
Preparation and Use of Terminology in ASTM Standards
Legal Aspects in Standards—Special Instructions
Standards Style Manual
Use of Metric (SI) Units in ASTM Standards

Seventh Edition

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PREFACE

ASTM, founded in 1898, is a scientific and technical organization formed for "the development of standards on characteristics and performance of materials, products, systems, and services; and the promotion of related knowledge." It is the world's largest source of voluntary consensus standards.

The purpose of this manual is to promote uniformity of form and style in ASTM standards. Such uniformity is desirable because it helps the reader to find what he wants more easily and to understand what he reads more quickly. Such uniformity in a manuscript is necessary if it is to be published by ASTM. Deviations from ASTM style mean wasted time on the part of reviewers, typists, editors, typesetters, proofreaders, draftsmen, and photoengravers, and eventually the reader of the standard. This means money is wasted by the Society and time is lost in publication.

Responsibility for the *Form and Style for ASTM Standards* is vested in the Board of Directors. Revisions to this manual may be recommended by the Board of Directors, by the Committee on Standards, or by a technical committee or its Executive Subcommittee. Revisions affecting Parts A, B, C, D, and F will be referred to the Committee on Standards, Part E to the Committee on Terminology, Part G to the editorial staff, and Part H to Committee E-43 on Metric Practice. The Committee on Standards, a standing committee of the Board, has the following responsibilities as stated in its scope: "reviews all committee recommendations for actions on standards, verifies that the procedural requirements of the Society's regulations have been met, and is responsible for acceptance of such recommendations." The COS bylaws also state: "The Committee on Standards acts upon recommendations for changes and reviews all requests from technical committees for exceptions to the manual, *Form and Style for ASTM Standards*." In all cases, recommended changes to this manual in technical substance and format shall be referred to the Committee on Standards, which, at a regular meeting, shall rule on the merits of the recommendation. The COS recommendation shall be sent to the Board. Changes adopted by the Board of Directors shall be announced to the members and shall become effective on the date determined by the Board of Directors.

It is mandatory that all ASTM standards be consistent with the form and style given herein. Section 10.5 of the *Regulations Governing ASTM Technical Committees* states:

> The current edition of the *Form and Style for ASTM Standards* shall be followed in the writing of standards. Where technical considerations preclude such compliance, the Committee on Standards may allow exceptions upon a request by a committee, if supported by appropriate justification.

Suggestions for revision of this manual should be addressed to the Managing Standards Editor, ASTM, 1916 Race St., Philadelphia, PA 19103.

INTRODUCTION

This manual is the basic textbook for anyone writing an ASTM standard. A study of Parts A, B, or C will show the proper form for the principal types of standards including a detailed explanation of how to write each section, from the title to the appendixes. Included at appropriate places are examples and standard wording. Also included are examples of correctly written complete manuscripts of various types of standards. Where standards are referenced throughout the text of this manual, the volume of the *Annual Book of ASTM Standards* in which the standard appears is given in parentheses.

For easy reference purposes, each paragraph in an ASTM standard must be numbered. The modified decimal numbering system adopted is explained in Part D. Part E gives complete instructions for preparing standard definitions. Special instruction concerning patents, use of trademarks, open-end agreements, and other law-related problems are given in Part F.

Part G is a detailed Style Manual which includes among other things information on abbreviations, spellings, literature references, and preparation of illustrations.

ASTM policy is that metric (SI) units be included in all standards. Part H is included to aid the standards writer to incorporate these units correctly. If a standard exists in two versions, one of which is "hard metric," the other need not include SI equivalents.

In addition to the widespread availability of this manual, there are a number of other forms of assistance available to the ASTM standards-writer, as follows:

1. Editorial workshops, at which committee members may confer with an editor from the Standards Department, are held at the time of a technical committee meeting under the sponsorship of the committee's editorial subcommittee, or are held at an Officers' Conference.

2. Personal editorial assistance at Committee Weeks. An editor from the Standards Department is usually available throughout the week to assist committee members with any editorial matters and questions regarding publications.

3. A representative from Committee E-11 on Statistical Methods is usually available to assist committee members with writing sections on sampling and precision and bias. Assistance at other times may be arranged through the Staff Manager of Committee E-11. Other ASTM committees providing assistance to committees are Committees E-36 for laboratory accreditation and E-46 for quality assurance matters.

4. The *Compilation of ASTM Standard Definitions*[1] is an indispensable reference in the coordination of terminology and in efforts to avoid conflicting and redundant definitions. Its sponsor, the Committee on Terminology, also stands ready to advise and assist committees on a personal level either through direct visits of COT members to committee meetings or through the technical committee's liaison representative to COT. Contact the COT Secretary at Headquarters.

5. ASTM Standard E 380 for Metric Practice,[1] and its sponsor, Committee E-43 on Metric Practice, and its supplements are the source of all information on SI, the International System of Units, and its application.

6. *Standardization News* occasionally has articles under the heading "Editorial Workshop," which expand on the material in this manual. Examples include topics on preparing manuscripts, titles, metrication, indexing, definitions, editorial changes, and editorial subcommittees.

7. The compilation *Standards on Precision and Bias for Various Applications*[1] contains all ASTM standards relating to the development of precision and bias statements in ASTM test methods.

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[1] Available from ASTM Headquarters.

DEFINITIONS

The definitions for the terms *standard, proposal*, and *emergency standard* and for their principal types, *classification, guide, practice, specification, terminology*, and *test method*, are quoted below from the current *Regulations Governing ASTM Technical Committees*.

standard—*as used in ASTM*, a document that has been developed and established within the consensus principles of the Society and that meets the approval requirements of ASTM procedures and regulations.

Discussion—The term "standard" serves in ASTM as an adjective in the title of documents, such as test methods or specifications, to connote-specified consensus and approval. The various types of standard documents are based on the needs and usages as prescribed by the technical committees of the Society.

proposal—a document that has been approved by the sponsoring committee for publication for information and comment prior to its consideration for adoption as a standard.

Discussion—Complete balloting procedures are not required for proposals. (See Regulation 13.1.)

emergency standard—a document published by the Society to meet a demand for more rapid issuance of a specific standard document.

Discussion—The Executive Subcommittee of the sponsoring committee must recommend the publishing of an emergency standard and the Committee on Standards must concur in the recommendation. Emergency standards are not full consensus documents because they are not submitted to Society ballot. (See Regulation 13.2.)

classification—a systematic arrangement or division of materials, products, systems, or services into groups based on similar characteristics such as origin, composition, properties, or use.

guide—a series of options or instructions that do not recommend a specific course of action.

Discussion—Whereas a practice prescribes a general usage principle, a guide only suggests an approach. The purpose of a guide is to offer guidance, based on a consensus of view-points, but not to establish a fixed procedure. A guide is intended to increase the awareness of the user to available techniques in a given subject area and to provide information from which subsequent evaluation and standardization can be derived.

practice—a definitive procedure for performing one or more specific operations or functions that does not produce a test result. (Compare **test method**.)

Discussion—A practice is not a downgraded test method. Examples of practices include procedures for conducting interlaboratory testing programs or other statistical procedures; for writing statements on sampling or precision and accuracy; and for selection, preparation, application, inspection, necessary precautions for use or disposal, installation, maintenance, and operation of testing equipment.

specification—a precise statement of a set of requirements to be satisfied by a material, product, system, or service that indicates the procedures for determining whether each of the requirements is satisfied.

Discussion—It is desirable to express the requirements numerically in terms of appropriate units together with their limits.

terminology—a document comprising definitions of terms; descriptions of terms; explanations of symbols, abbreviations, or acronyms.

test method—a definitive procedure for the identification, measurement, and evaluation of one or more qualities, characteristics, or properties of a material, product, system, or service that produces a test result. (Compare *practice*.)

Examples are given in Appendix X1.

PART A
FORM OF ASTM TEST METHODS

INTRODUCTION

An ASTM test method, as defined on p. vi, typically includes a concise description of an orderly procedure for determining a property or constituent of a material, an assembly of materials, or a product. The directions for performing the test should include all of the essential details as to apparatus, test specimen, procedure, and calculations needed to achieve satisfactory precision and bias.

An ASTM test method should represent a consensus as to the best currently available test procedure for the use intended. It should be supported by experience and adequate data obtained from cooperative tests.

In order to be the "best currently available," test methods need periodic review to determine whether revisions are desirable as the result of technological advances in manufacturing, testing, and use requirements.

ASTM test methods are frequently intended for use in the buying and selling of materials according to specifications and therefore should provide such precision that when the test is properly performed by a competent operator the results will be found satisfactory for judging the compliance of the material with the specification. These test methods cover the determination of fundamental properties of materials such as density, absolute viscosity, softening point, flash point, etc. They may include a variety of different laboratory procedures such as chemical and spectrochemical analyses, mechanical and electrical tests, weathering tests, visual examination, fire tests, performance characteristics, sampling, nondestructive tests, radiation exposure tests, etc. In some standards, optional test methods are included.

It should be noted here that statements addressing precision and bias are required in ASTM test methods. This gives the user of the test method an idea of the nature of the sample to be prepared and analyzed and information regarding the nature of the data obtained by using the method. The requirement of precision and bias statements does not mean that numerical statements must be generated. It means that the spread of resulting data and its relationship to an accepted reference material or source (if available) must be addressed. Some test methods will have no numerical expression of precision or bias possible (pass/fail tests, spot tests, etc.). In these cases, precision and bias must be addressed and the reasons for not including relevant data explained. Test methods are sometimes prepared for use in research rather than in the buying and selling of materials. Other test methods cover process control, screening, and field tests. Although these latter test methods may not always be as precise as referee test methods, they are sufficiently precise for the intended use and usually require less time. Field tests allow testing at the site, thus eliminating transportation of specimens to and from the laboratory.

Special instructions with respect to the legal aspects must be adhered to in writing any standard. These include such matters as contractual items, caveat statements, and patents. See Part F for details.

When a standard is being developed, the costs associated with its development and subsequent use generally should be taken into account. The prime objective should be the optimum use of resources to achieve satisfactory definition of the product or service. However, it should be noted that when the standard relates to the safety of persons, cost considerations are likely to become much less important than when attributes of materials or products are involved. Some standards, such as definitions, impose no cost on the user; others that include numerous and extensive requirements can entail significant expense to users of the standard. The requirements to be included should, therefore, be those that are technically relevant and yield benefits commensurate with the cost of their determination.

Cost effectiveness statements or rationale may be included within a standard if appropriate, usually in an appendix.

A1. Subject Headings of Text

A1.1 The following is the preferred sequence for the text of ASTM test methods:

* Title
† Designation
† Introduction
* Scope
† Referenced Documents
† Terminology
Summary of Test Method
* Significance and Use
Interferences
Apparatus
Reagents and Materials
Hazards (required when applicable)
Sampling, Test Specimens, and Test Units
Preparation of Apparatus
Calibration and Standardization
Conditioning
* Procedure
Calculation or Interpretation of Results
Report
* Precision and Bias
† Annexes and Appendixes
† References

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* The headings marked with an asterisk (*) are required in all test methods. Where the subject is inapplicable, the heading shall be included with a statement of the reasons for its inapplicability.

† The headings marked with a dagger (†) should appear only once in test methods that contain two or more test procedures.

A1.2 The headings in A1.1 are those most generally used. Not all of these headings may be required for a particular test method. Also, it may be necessary to use other appropriate headings in test methods covering a specialized subject. These should appear in the most appropriate place, depending on their relation to the sections listed in A1.1. When a standard includes several test methods, repetition of appropriate headings may be desirable.

A1.3 Subject headings in boldface type shall precede each section to orient the reader. Text divisions shall be subdivided in accordance with the Guide to the Use of the Modified Decimal Numbering System in Part D of this publication. An example of a typical test method is shown in the Appendix.

A1.4 For convenience in application and when economy in printing may result, test methods may include a series of procedures for determining different properties of a given material. In such test methods, include at the beginning of the standard individual sections describing those features that are common to all of the separate test procedures.

A1.5 Examples of test methods for single determination:

B 331, Test Method for Compressibility of Metal Powders in Uniaxial Compression (Vol 02.05)
C 693, Test Method for Density of Glass by Buoyancy (Vol 15.02)

A1.6 Examples of test methods covering a series of test procedures:

D 1179, Test Methods for Fluoride Ion in Water (Vol 11.01)
D 2137, Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics (Vols 09.01 and 09.02)
F 38, Test Methods for Creep Relaxation of Gasket Materials (Vol 09.02)

A1.7 In deciding whether to describe similar test methods as portions of a single standard or as separate test methods, the following criterion may be found useful: When the descriptions of the apparatus and procedure are similar and a significant economy in printing can be accomplished by combining, and if, because of clearly understood distinctions in applicability, no confusion can arise as to which test method should be used, then it is desirable to treat the test methods as parts of a single standard. If confusion could arise, the test methods should be published separately. If one test method is preferred as a referee method, it should be so designated, in which case the other test methods should be designated as optional or nonreferee. When test methods are published separately, a worthwhile saving can be accomplished by making cross-references from one test method to another for the apparatus and detailed description of the procedure.

A2. Title (Required)

A2.1 The title should be concise but complete enough to identify the nature of the test, the material to which it is applicable, and to distinguish it from other similar titles. Titles of analogous standards should be identical, except for the distinctive feature(s) of each standard. Titles are used frequently in lists, tables of contents, indexes, tabulating card systems, etc., and therefore must be brief but inclusive. Select words that easily lend themselves to indexing. The essential features of a title are the particular property or constituent being determined, the material to which the test method is applicable, and when pertinent, the technique or instrumentation. If the test method is designated to determine a number of constituents or properties, use a general title, omitting the names of specific constituents or properties. When a standard includes a number of individual test methods for different constituents or properties, the title need indicate only the general nature of the tests and the material to which it is applicable.

A3. Designation and Year of Issue

A3.1 *Designation*—The ASTM designation, assigned by Headquarters on submittal for approval, consists of the following sequential parts:

A3.1.1 A letter designation denoting in general the classification according to material, product, system, or service.

A —Ferrous metals and products
B —Nonferrous metals and products
C —Cementitious, ceramic, concrete, and masonry materials
D —Miscellaneous materials and products
E —Miscellaneous subjects
F —End-use materials and products
G —Corrosion, deterioration, weathering, durability, and degradation of materials and products
ES—Emergency standards
P —Proposals

A3.1.2 A sequential number following the letter designation (see also A3.4).

A3.1.3 The letter "M" following the alphanumeric designation (A3.1.1 and A3.1.2) indicates that acceptable metric units are included in this document as a standard unit of measurement (see also A3.4).

A3.2 *Year of Issue*

A3.2.1 After the designation, a hyphen is followed by the last two numbers of the year of acceptance or of last revision. If the standard is revised again during the same year, this is indicated by adding an "a" for the second revision, "b" for the third revision, etc.

A3.2.2 The parenthetical phrase "(Reapproved 19__)" to designate the year of last reapproval of a standard, if applicable.

A3.2.3 For editorial changes that do not change the year designation, a note is inserted before the text to indicate the location and date of the change and a superscript epsilon (ε) is added after the year designation. The epsilon designations and corresponding notes are numbered chronologically and are deleted upon occasion of the next revision or reapproval.

A3.3 The designation numbers of standards that have been discontinued will not be reassigned.

A3.4 *"M" Standards* (see also H2):

A3.4.1 *Companion Standards*—If a standard is written in acceptable metric units and has a companion standard written in inch-pound units (or other units), the metric standard is identified by adding the letter "M" immediately after the sequential alphanumeric designation of the companion document. For example, A 109M is the designation for the metric companion of A 109. No significant technical differences shall exist between an "M" standard and the corresponding companion standard; each is to provide equivalent results. When companion standards exist, each standard should contain a text note acknowledging the existence of the other. The wording of the text in the scope of an inch-pound (or other unit) standard might be:

1.X—A complete metric companion to Specification A 000 has been developed—A 000M; therefore, no metric equivalents are shown in this specification.

The wording of the scope text in a metric standard might be:

1.Y—This specification is the metric companion of Specification A 000.

A3.4.2 *Combined Standards*—If the standard is written in inch-pound units (or other units) and acceptable metric units, the document is identified by a dual alphanumeric designation, for example, A 36/A 36M. The wording of the text in the scope of the combined standard might be:

1.Z—The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in noncomformance with the specification.

A4. Introduction

A4.1 A separate section covering general introductory or informational material is not generally used in ASTM test methods. Occasionally, a test method is of such a nature that it requires an explanatory statement for proper understanding by the user. In such instances an introduction may be included immediately after the title of the test method but without a section number.

A4.2 Examples of test methods that include introductions are as follows:

D 143, Methods of Testing Small Clear Specimens of Timber (04.09)
D 905, Test Methods for Strength Properties of Adhesive Bonds in Shear by Compression Loading (Vol 15.06)

A5. Scope (Required)

A5.1 Include here information relating to the purpose, application, etc., of the test method. State the range of application of the test method as completely as possible; do not sacrifice clarity for brevity. Avoid repetition of information included in "Significance and Use" (see Section A9). If the method covers several tests, each with its own scope, include a statement regarding the scope of each such test in this general section on Scope.

A5.2 Include separately any appropriate comments on limitations of the test. Indicate any means of recognizing cases where the test method may not be applicable to the material under test.

A5.3 In standards that cover a number of test methods, include a separate alphabetic list of the test methods, together with the corresponding section numbers.

A5.4 Include in this section any caveats required by ASTM policy such as, the caveats on *safety hazards* (see Section F2.1) and fire hazards (see Section F2.2).

A5.5 Include in this section the system of units to be used in referee decisions (see H4.3).

NOTE A1—Reference to *alternative, companion,* or *related* standards may be included in a note in the scope. The title and designation of such standards shall be included in the Referenced Documents section.

A6. Referenced Documents

A6.1 List in alphanumeric sequence the designation and complete title of the following documents referenced within the standard: ASTM standards, proposals, and adjuncts; and standards and codes of other organizations. For references to all other documents, including ASTM STPs, use the format indicated in Section G33.

A6.2 Provide footnotes to this section to indicate the sources of these documents. When ASTM standards are referenced later in the text, use only the type of standard (that is, specification, test method, practice, classification, guide, terminology, etc.) and the designation letter and number (for example, Test Method D 1310).

A6.3 The designations of referenced documents should not include the year of issue since they are subject to revision without relation to the parent standard, and dates of publication do not necessarily coincide with approval dates.

A6.4 When listing referenced adjuncts, provide a brief description in this section, and a footnote of the availability. (For more specific information on adjuncts, refer to Section A26.)

A7. Terminology (See also Part E)

A7.1 If applicable, refer to existing ASTM definitions standards having general applications.

A7.1.1 Examples of ASTM definitions standards having general application are:

D 123, Terminology Relating to Textiles (Vols 07.01 and 07.02)
E 631, Terminology of Building Constructions (Vol 04.07)

A7.2 *Definitions*—These must be in dictionary-definition form, following the guidelines of Part E of this publication. If desirable, repeat here applicable definitions from a definitions standard.

A7.2.1 Examples of ASTM test methods incorporating definitions are:

D 885, Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Man-Made Organic-Base Fibers (Vol 07.01)
E 384, Test Method for Microhardness of Materials (Vol 02.05)

A7.3 *Descriptions of Terms Specific to This Standard*—Terms that are specific (or applicable) only to the standard shall appear under this heading.

A7.3.1 Examples of ASTM test methods incorporating descriptions of terms are:

C 209, Methods of Testing Insulating Board (Cellulosic Fiber), Structural and Decorative (Vol 4.06)
F 42, Test Methods for Conductivity Type of Extrinsic Semiconducting Materials (Vol 10.05)

A7.4 *Symbols*—In a standard with many equations containing quantity symbols, it may be convenient to list all of the symbols in this section rather than under each equation.

A7.4.1 Examples of ASTM test methods having a section on symbols are:

C 522, Test Method for Airflow Resistance of Acoustical Materials (Vol 04.06)
E 1036, Test Methods for Electrical Performance at Nonconcentrator Terrestrial Photovoltaic Modules and Arrays Using Reference Cells (Vol 12.02)

NOTE A2—As definitions are developed, it is recommended that they be submitted to the Committee on Terminology (COT), for review with respect to form and the guidelines in Part E. The role of the COT is described in Part E of this book.

A8. Summary of Test Method

A8.1 Include here a brief outline of the test method, describing in the passive voice its essential features without the details that are a necessary part of the complete statement of procedure. If desired, a brief statement of the principle of the test method may be given; this is particularly desirable in the case of chemical methods and should appear as the first paragraph. In chemical methods state the type of procedure, such as colorimetric, electrometric, volumetric, etc., and describe the source of color, major chemical reaction including pertinent chemical equations, etc.

A9. Significance and Use (Required)

A9.1 Include in this section information on the usefulness of each test procedure described, stating first the most significant features. Such statements should be concise without sacrificing important ideas or completeness and should provide the user of the method with an understanding of the following:

A9.1.1 The meaning of the test as related to the manufacture and end use of the material,

A9.1.2 The suitability of the test for specification acceptance, design purposes, service evaluation, regulatory statutes, manufacturing control, development and research, and

A9.1.3 The fundamental assumptions inherent in the method that may affect the usefulness of the results.

A9.2 Include any warning needed in the interpretation of the results of the test.

A9.3 Examples of test methods that include sections on significance are:

D 4501, Test Method for Shear Strength of Adhesive Bonds Between Rigid Substrates by the Block-Shear Method (Vol 15.06)
E 1063, Test Method for X-Ray Emission Spectrometric Determination of Cerium and Lanthanum in Carbon and Low-Alloy Steels (Vol 03.06)

A10. Interferences

A10.1 If the successful application of the test method requires the inclusion of explanatory statements on interference effects, include such information here; otherwise, omit this section. List briefly the constituents or properties that are likely to cause interference and the amounts that are known to interfere. In some cases this information can be obtained only by observation during the performance of the test. If the presence of an interfering factor may affect the precision or bias of the test results and compensations can be made in the calculations (Section A19), this should be explained in this section and noted in the appropriate section. In some cases, interferences may be a major factor in judging test results. Where this becomes a lengthy explanation, an annex to the standard should be considered.

A11. Apparatus

A11.1 In this section, include a brief description of the essential features of the apparatus and equipment required for the test, and, where they will clarify or supplement the text, schematic drawings or photographs. Cover in separate text divisions the important features and requirements for the apparatus. Do not list common laboratory apparatus, such as flasks, beakers, etc., but include any especially modified forms or unusual sizes of common apparatus that are required or that may require special preparation.

A11.2 Avoid the use of trademarks, unless a specific manufacturer's product is required for a well-defined reason (see Section F4). In such cases an explanatory footnote may be included giving supplementary information regarding such apparatus or material. The footnote should state that this apparatus or material or its equivalent "has been found satisfactory for this purpose." When special types of glassware are required, such as heat-resistant, chemical-resistant, etc., state the significant characteristic desired rather than a trademark. For example, use "borosilicate glass" rather than "Pyrex" or "Kimax." Specify filter paper by describing the significant characteristic such as porosity, rate of filtering, ash content, etc., or by reference to ASTM Specification E 832, for Laboratory Filter Papers (Vols 14.02 and 15.09).

NOTE A3—Policies have been adopted by the Board of Directors that are applicable to standards involving patented apparatus, materials, and processes. These policies are described in the Regulations Governing ASTM Technical Committees. Before submitting to subcommittee or main committee ballot any draft test method that requires a specific manufacturer's product, consult the Staff Manager of your committee as to necessary conformance with the Regulations Governing ASTM Technical Committees.

A11.3 Detailed manufacturing requirements for apparatus, unless quite brief, should preferably be placed in an annex to the test method (see A22.3), retaining in the text only a brief outline with schematic drawings or illustrations where necessary. The purpose of this outline is to provide information regarding the essential features of the apparatus, to enable the user to assemble the equipment and understand its use in the method.

A11.4 When essentially the same apparatus is used for more than one standard and the description of the apparatus requirements is lengthy, it is recommended that the complete specifications for the apparatus be included in an annex to one standard and merely a reference be made to them in the other standard, mentioning under "Apparatus" only such modifications as may apply in each particular case.

A11.5 When the same apparatus is used in several standards, the detailed specifications may be covered by a separate ASTM standard. Examples of such standards are:

E 1, Specification for ASTM Thermometers (Vol 14.01)
E 133, Specification for Distillation Equipment (Vol 14.02)

A11.6 It is the responsibility of the sponsoring committee to assure itself that suitable apparatus is available (see Section F4). If the apparatus has to be built, blueprints, plans, etc., can be cited in a footnote in this section as available through ASTM Headquarters as adjunct material to the standard.

A12. Reagents and Materials

A12.1 When more than one procedure is included in one standard, list the reagents and materials required for each procedure as a separate section under each subdivision.

A12.2 It is recommended that, where applicable, the following be included as secondary sections ".1" and ".2" of this section:

> 6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[7] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.
>
> 6.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type ___ of Specification D 1193.
>
> ---
>
> [7] "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY, and the "United States Pharmacopeia."

NOTE A4—The identifying numbers (for example 6.1 and 6.2 as above) used in recommended texts are for illustrative purposes.

A12.2.1 If a different grade of water is required, add a second sentence as follows: "Water conforming to the following specifications is required" (list the specific properties, kinds of ion freedom, etc.).

A12.2.2 In standards covering two or more chemical methods these statements on purity should be made in a separate section entitled "Purity of Reagents."

A12.3 List the reagents alphabetically in separate divisions. Give the name of the reagent first, followed by any descriptive terms (see A12.7). State the desired concentration if significant; then follow with instructions for preparation and standardization (if required), using the imperative mood and concise descriptions. Spell out the full name of the reagent, and immediately after the first mention of the name include within parentheses the exact chemical formula of the reagent showing any water of crystallization, etc. Exception to this may be made in the case of organic, organometallic, or complex inorganic compounds by omitting the chemical formula. Subsequent references to compounds shall be by formula only where they can be clearly specified by this means, as in the case of most inorganic compounds. As exceptions, always spell out the word "water" and the name of substances in their elementary state; for example, use lead, not Pb; oxygen, not O_2. If the reagent is to be used as purchased, and not diluted, dissolved, or purified, state the chemical formula as given by the manufacturer.

A12.4 Avoid the use of trademarks and names of patented products, using chemical names only, unless a specific product is required for a well-defined reason. In this case, use a superior reference number to refer to a footnote giving the required information, incorporating the phrase "has been found satisfactory for this purpose." Where particular reagents are required only for standardization or calibration, identify them by reference to an appropriate footnote such as "This reagent is used for standardization purposes only."

A12.5 Specify the reagent concentration in applicable terms, as follows:

Concentrated acids and bases . . . density, unless mass percent is/are generally used or required
Dilute acids and bases . . . volume ratio, $X + Y$ (X volumes of reagent added to Y volumes of water)
Nonstandardized solutions . . . grams of reagent as weighed out per litre of solution
Standardized solutions . . . normality, expressed decimally; or the equivalent of 1 mL of solution in terms of grams of a given element expressed as "1 mL = x.xx g of . . . ."

A12.6 Wherever possible, use the same concentrations of reagents and methods of standardization as used in other similar ASTM test methods.

A12.7 Examples of reagent descriptions are as follows:

A12.7.1 *Ammonium Carbonate* ($(NH_4)_2CO_3$).

A12.7.2 *Barium Chloride Solution* (100 g/L)—Dissolve 100 g of barium chloride ($BaCl_2 \cdot 2H_2O$) in water and dilute to 1 L.

A12.7.3 *Potassium Hydroxide, Methanol Solution* (33 g/L)—Dissolve 33 g of potassium hydroxide (KOH) in methanol and dilute to 1 L with methanol.

A12.7.4 *Sodium Thiosulfate, Standard Solution* (0.1 *N*)—Dissolve 24.82 g of sodium thiosulfate ($Na_2S_2O_3 \cdot 5H_2O$) in water and dilute to 1 L in a volumetric flask. Preserve the thiosulfate solution by adding 5 mL of chloroform or 1 g of sodium hydroxide (NaOH) per litre. Determine the exact normality by titration against a standard solution of equivalent strength of potassium acid iodate ($KH(IO_3)_2$) or potassium dichromate ($K_2Cr_2O_7$).

A13. Hazards

A13.1 *Safety Hazards*—Section F2.1.1 specifies the generic safety hazards caveat and the types of standards in which it shall be used. Other statements on safety are subject to the following policies.

A13.1.1 *Warning Statement*—A *warning* statement identifies a specific hazard. When there are hazards to personnel, such as explosion, fire, toxicity, or radiation, a warning statement shall be placed at the appropriate point in the text by inserting a note beginning with "Warning" in boldface type followed by a description of the hazard, or a reference to a description of the hazard within the body of the standard.

A13.1.2 *Precautionary Statement*—A precautionary statement provides information for avoiding or minimizing a particular hazard. Primary responsibility for precautions is placed on the user of the standard by the generic caveat. Where a precaution is unique to a specific standard, a specific precautionary statement may be included as a note provided it begins with the words, "Precaution (in boldface type)—In addition to other precautions. . . ."

A13.1.3 *Remedial Statements*—A remedial statement provides recommendations for treating a situation resulting from an unsuccessfully controlled hazard *associated with the use of a standard*. Such remedial statements shall not be included in standards, but reference may be made in a note to authoritative sources where reliable information about remedial measures can be obtained.

A13.2 *Technical Hazards*—Information on certain procedures that may give erroneous results or that may cause damage to equipment may be included as a note and shall begin with the word "Caution" in boldface type. Examples of methods that include technical cautionary or precautionary statements are:

D 129, Test Method for Sulfur in Petroleum Products (General Bomb Method) (Vol 05.01)
D 1687, Test Methods for Chromium in Water (Vol 11.01)

A14. Sampling, Test Specimens, and Test Units

A14.1 Under this heading give necessary special directions, in the imperative mood, for physically obtaining sample test units. If a test result is defined as a combination of the observations made on different test specimens, particularly describe how these specimens are to be selected. Give necessary special directions for storage of specimens, for preservation of specimens, and for special preparation of specimens for the test.

A14.2 Statistical aspects of sampling for a specific purpose, say, for determining conformance of the mean properties of a lot to specifications, may be referenced or discussed in an appendix. These statistical aspects might include stratification, selecting of primary and secondary sampling units, the number of such units to be selected, in the case of bulk material the number of increments combined to form a composite sample, the number of composites to be formed, the method of subsampling a composite, and the number of tests made on a subsample.

A14.3 If the method of sampling is described in an existing ASTM test method or ASTM specification, refer to that test method or specification by designation.

A14.4 If the method of sampling is detailed in a readily available publication other than an existing ASTM standard, refer to the publication in a footnote, arranging the information in accordance with the suggestions presented in the Style Manual, Part G, of this publication.

A14.5 Where an existing sampling method (other than ASTM) is cited in a test method, guidelines should be given as to the use of the sampling scheme and precautions if needed. If explanatory documents regarding sampling are available, these should be cited in this section.

A14.6 A *test unit* is a unit or portion of a material that is sufficient to obtain a test result(s) for the property or properties to be measured. A *test specimen* is a test unit or portion of a test unit upon which a single or multiple observation is to be made. A *test result* refers to the value obtained for a given property from one test unit. A test unit may be a subunit of a primary (first stage) sampling unit or it may be a subunit of a composite of primary sampling units or of increments from these primary sampling units. A test result may be a single observation or a combination of a number of observations when two or more test specimens are measured for each test unit.

A14.7 The size of the test unit for chemical analysis usually is given in the "Procedure" section, but if significant in connection with pretreatment or preparation, it may be included here. When a test specimen is specified by mass, indicate the degree of precision desired.

A14.8 Include detailed requirements as to the size and number of test specimens to be used for both physical and chemical tests. Where a test specimen or test unit of a particular shape is required, the essential dimensions shall be specified, including tolerance. A drawing showing the details of the specimen or test unit may be included.

A15. Preparation of Apparatus

A15.1 Use this section only when detailed instructions are required for the initial assembly, conditioning, or preparation of the apparatus (also see A22.3).

A16. Calibration and Standardization

A16.1 *Apparatus*—Give such detailed instruction, in the imperative mood, for calibration and adjustment of the apparatus as may be necessary to the use of the test method.

A16.2 *Reference Standards and Blanks*—Give detailed instructions for the standardization and use of reference standards and blanks used in the test method. Describe any standard samples used to assure uniformity of the test technique, and standard specimens or photographic standards.

A16.3 *Calibration Curves and Tables*—Give detailed instructions for the preparation and use of calibration curves or tables, in accordance with the suggestions presented in the Style Manual, Part G of this publication. Include in the instructions for curve or table preparation items such as calibration, solutions, reference standards, blanks, color development, photometry, construction, etc.

A17. Conditioning

A17.1 Specify, in the imperative mood, the conditioning atmosphere to be used and the time of exposure to the atmosphere, as well as the atmosphere required during the test, where necessary. State whether the conditioning requirements apply to laboratory samples as well as individual specimens. Indicate any requirements for preconditioning. Where applicable, refer to ASTM Definitions E 41, Terms Relating to Conditioning (Vol 14.02), and to ASTM Specification E 171, for Standard Atmospheres for Conditioning and Testing Materials (Vol 15.09).

A17.2 Examples of standards which include conditioning requirements are:

D 2289, Test Method for Tensile Properties of Plastics at High Speeds (Vol 08.02)

D 2654, Test Methods for Moisture Content and Moisture Regain of Textiles (Vol 07.02)

A18. Procedure (Required)

A18.1 Include in proper sequence detailed directions for performing the test. Describe the procedure in the imperative mood, present tense, for example: "Heat the test specimen . . ." rather than "The test specimen shall be heated . . ." State the number of samples to be taken, and also state the number of specimens to be tested from each sample. Describe in detail the successive steps of the procedure, grouping related operations into logical divisions. Subheadings may be used if they will help the organization of the material. Make the text of the procedure concise, to the point, and easily understandable. When alternative procedures are given, state their relative status, that is, which is the preferred or referee procedure.

A18.2 In chemical methods, specify the size of test specimen and indicate the degree of precision desired in the weighing. Consider the specimen size and its accuracy of weighing in connection with the ultimate use of the method. If the formula for a reagent has been given previously in accordance with the instructions given in A12.3, refer to the reagent by chemical formula only or name, whichever is less confusing. Otherwise, spell out the name of the reagent. The procedure should provide for any operations necessary to obtain any correction data that may be needed.

NOTE A5—Supplementary information regarding the procedure such as technical details or discussion to amplify the test procedure or alternative direction, may be included in a note. Instructions or details essential to the procedure must not appear in notes.

A19. Calculation or Interpretation of Results

A19.1 *Calculation*—Give here, in the imperative mood, directions for calculating the results of the test, including any equations (also see Section G21). Spell out names in the text but use letter symbols in the equations to designate individual values. Refer to ANSI Y10.3 for suggested quantity symbols such as E for Young's modulus, P for pressure, etc. Use numerical values for any constants. Describe the letter symbol immediately under the equation (unless a section on symbols is included; see A7.4). Avoid the use of combined factors in chemical methods. Indicate the reference point on which the calculations are based, such as on the sample as received, dry basis, etc., and the units in which the results are reported. If necessary for clarity, a typical calculation may be included in an explanatory note.

A19.1.1 An example of a typical equation is:

$$\text{Aluminum, \%} = \frac{(A \times B) \times 0.0587}{C} \times 100$$

where:

A = grams of aluminum oxyquinolate found in the aliquot used,
B = grams of aluminum oxyquinolate found in the blank, and
C = grams of sample represented in the aliquot used.

A19.2 *Interpretation of Results*—Use this heading in place of "Calculation" when the results of the test must be expressed in descriptive form, relative terms, or abstract values. List and define the descriptive terms or classifications used. The results of a test may be interpreted or expressed in terms of a rating scale. There is fairly wide agreement on five-step scales for many values or rankings of merit, with 5-good, 3-middle, 1-

bad. In general a higher score for more of a desirable property is the more satisfactory arrangement. This eliminates confusion arising from No. 1 in rank for the most of a quantity, without regard to the relative desirability.

A19.2.1 Examples of methods that include rating systems are:

D 130, Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test (Vol 05.01)

D 3511, Test Methods for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Brush Pilling Tester Method (Vol 07.01)

A20. Report

A20.1 State in this section the detailed information required in reporting the results of the test. When two or more procedures are described in a test method, the report shall indicate which procedure was used. When the test method permits variations in operating or other conditions, incorporate in the report a statement as to the particular conditions used in the test. As an aid in the calculation and uniform recording of test results a standard report form or work sheet may be used, and if desirable a facsimile of the form may be included in the test method. Introduce the section as follows: "Report the following information:"

A21. Precision and Bias

A21.1 *Statement on Precision* (Required):

A21.1.1 Precision is the closeness of agreement between randomly selected individual measurements or test results. For definitions of other statistical terms, refer to Terminology E 456, for Statistical Methods (Vol 14.02).

A21.1.2 A statement on precision allows potential users of the test method to assess in general terms its usefulness in proposed applications. A statement on precision is not intended to contain values that can be duplicated in every user's laboratory. Instead the statement provides guidelines as to the kind of variability that can be expected between test results when the test method is used in one or more reasonably competent laboratories.

A21.1.3 Variation in test results is a consequence of variation in the materials tested and variation in application of the test method. With respect to a test method, the statement about precision shall refer to the variation that results from application of the test method to material in which variation is as small as can reasonably be attained.

A21.1.4 In the usual case, when the data lend themselves to the procedures in Practice E 691, for Conducting an Interlaboratory Test Program to Determine the Precision of a Test Method (Vol 14.02), the measures of precision shall be estimated as directed in Practice E 691 or in another interlaboratory practice that will yield equivalent information. Other cases will require special treatment.

A21.1.5 Every test method shall contain a statement (*1*) about the precision of test results obtained in the same laboratory under specifically defined conditions of within-laboratory variability (repeatability conditions) and (*2*) about the precision of test results obtained in different laboratories (reproducibility conditions).

A21.1.5.1 The specifically defined within-laboratory conditions may concern test results obtained on the same material by the same operator using the same equipment within a short period of time, or within-laboratory precision may be reported for other specified conditions. The particular within-laboratory variability for which precision is reported shall be described in detail.

A21.1.5.2 The statement regarding between-laboratory variability must pertain to test results obtained in different laboratories on the same specimen or on random specimens of the same material.

A21.1.6 The standard deviation or other index of precision shall be given for each type of precision that is reported; usually the repeatability standard deviation and the reproducibility standard deviation. In addition, the precision statement shall include 95 % repeatability and reproducibility limits on the difference between two test results.

A21.1.7 If the responsible subcommittee decides an interlaboratory study should be delayed until the test method has been published, a temporary statement addressing only within-laboratory precision will be permitted initially. For a properly developed new or revised test method, a preliminary statement on within-laboratory precision should be possible based on evaluations made in at least one laboratory. In the event no information is available on within-laboratory precision, the responsible subcommittee may use a temporary statement as follows:

> 11.2 *Precision*—The precision of the procedure in Test Method X 0000 for measuring (insert here the name of the property) is being determined.

Such temporary statements imply a promise to obtain more complete information about precision and shall not appear in a test method for more than 5 years without special permission from COS (Committee on Standards).

A21.1.8 If it is not practicable to provide a statement on precision as directed in A21.1.5, the responsible subcommittee may use a statement such as the following:

> 11.3 *Precision*—It is not practicable to specify the precision of the procedure in Test Method X 0000 for measuring (insert here the name of the property) because (insert here the reason or reasons).

Citing impracticability is not warranted if the reason is that an interlaboratory test has revealed that the precision is poor.

A21.1.9 The data obtained in the interlaboratory study and the detailed analysis of the data shall be filed at ASTM Headquarters, and the reference number for this file shall be included in the precision statement (see Section A27).

A21.2 *Statement on Bias* (Required):

A21.2.1 Bias is a systematic error that contributes to the difference between a population mean of the measurements or test results and an accepted reference or true value. For definitions of other statistical terms, refer to Terminology E 456, for Statistical Methods (Vol 14.02)

NOTE A6—Accuracy is the closeness of agreement between an observed value and an accepted reference value. When applied to individual observations, accuracy includes a combination of a random component and a component due to systematic error. Under these circumstances, accuracy contains elements of both precision and bias. For this reason ASTM has changed from reporting precision and accuracy to reporting precision and bias.

A21.2.2 A statement on bias furnishes guidelines as to whether the test method can be used when comparisons to accepted reference values are to be made. If the bias is known, the test method can be modified to include a correction for the bias, and thus the corrected test method would be without known bias.

A21.2.3 A statement on bias shall describe the bias and how the test method has been modified to provide corrected results. If bias cannot be determined, a statement to this effect shall be included.

A21.2.4 Even when a quantitative statement on bias is not possible, it is very helpful to the user of the test method to know that the developers of the test method have considered the possibility of bias. In such cases, a statement on bias based on the following examples may be used.

> 11.4 *Bias*—The procedure in Test Method X 0000 for Measuring (insert here the name of the property) has no bias because the value of (insert here the name of the property) can be defined only in terms of a test method.
>
> 11.5 *Bias*—Since there is no accepted reference material suitable for determining the bias for the procedure in Test Method X 0000 for measuring (insert here the name of the property), no statement on bias is being made.
>
> 11.6 *Bias*—No justifiable statement can be made on the bias of the procedure in Test Method X 0000 for measuring (insert here the name of the property) because (insert here the reason).

A21.2.5 The data and the details of the experiment to determine bias shall be filed at ASTM Headquarters and the reference number for this file shall be included in the statement on bias (see Section A27).

A21.3 *General Considerations*

A21.3.1 If precision or bias, or both, varies with the test level, the nature of the variation shall be described in the statement on precision or bias, or both.

A21.3.2 The precision and bias statements shall also include a brief description of the experiment used to determine the precision and bias, such as: numbers of laboratories, number and types of materials, number and replicate test results per laboratory per material, and other appropriate information that will enable the user to assess the reliability and the degree of applicability of the precision and bias statements to materials of interest to him.

A21.3.3 The requirements set forth in A21.1 and A21.2 are intended to apply to a test method that results in a numerical measure such as, an individual determination, a mean of a number of determinations as specified by the test method, or a count. When a test method specifies that a test result is a nonnumerical report of success or failure based on criteria specified in the procedure, the statement on precision and bias should read as follows:

> 11.7 *Precision and Bias*—No statement is made about either the precision or bias of Method X 0000 for measuring (insert here the name of the property) since the result merely states whether there is conformance to the criteria for success specified in the procedure.

A21.3.4 When a test method specifies that the procedure in another ASTM test method is used without modification, no statements on precision and bias are necessary if those in the other method are applicable. When a test method states that the procedure in another ASTM test method is to be used with significant revisions, statements on precision and bias should be presented as directed in A21.1 and A21.2. When a test method specifies that the procedure in another ASTM test method is to be used with only insignificant modification(s), a statement such as the following should be used to reassure the reader that precision and bias are not affected by the modification(s).

> 11.8 *Precision and Bias*—The precision and bias of this test method for measuring (insert here the name of the property) are as specified in Test Method (insert here the designation for the other test method).

A22. Annexes and Appendixes

A22.1 Additional information may be included in one or more annexes and appendixes to the test method.

A22.2 The words "Mandatory Information" shall be included directly under the title of annexes and the words "Nonmandatory Information" shall be included directly under the title of appendixes.

A22.3 *Annexes*—Include in annexes any detailed information such as that on apparatus or materials that is a mandatory part of the test method but too lengthy for inclusion in the main text. Annexes shall precede appendixes. Examples of such information are as follows:

A22.3.1 Glossary of terms used in the method.

A22.3.2 List of symbols.

A22.3.3 Detailed description of apparatus.

A22.3.4 Instructions for calibrating and standardizing apparatus.

A22.3.5 Directions for cleaning apparatus, and

A22.3.6 Operating instructions and adjustments of specific makes of apparatus.

A22.4 *Appendixes*—An appendix to an ASTM standard is informative only and is not a mandatory part of the standard. Information on the following general subjects has been included in such appendixes:

A22.4.1 Notes on significance and interpretation of the test method, usually to amplify the statement in the text.

A22.4.2 Development of equations used in the calculations.

A22.4.3 Charts or supplementary information for computations, and

A22.4.4 Suggested data forms for recording test results.

A22.4.5 Commentary on rationale used in the development of the test method.

A23. References

A23.1 Include only references to publications supporting or providing needed supplementary information. Historical and acknowledgement references are not desirable. If there are five or more references, list them in an unnumbered section at the end of the test method in the order in which they appear in the text. If there are fewer than five literature references, use footnotes (see Section G33).

A24. Footnotes

A24.1 *General*—Footnotes referenced in the text are intended only for reference and should never include any information or instructions necessary for the proper application of the method. Table footnotes are a part of the table. Use consecutive superior numerals for reference to footnotes except in connection with tables, in which case use italic capital letters.

A24.2 *Committee Jurisdiction and History*—Footnote 1 shall include in the first paragraph the committee having jurisdiction and, where the committee so requests, the subcommittee. The second paragraph shall include history information as follows: (*1*) approval date of latest revision, (*2*) month and year of publication, (*3*) designation and year of original issue, (*4*) designation and year of previous issue, and (*5*) information as to any other standards that may have been replaced by the standard, year of redesignation, etc.

A24.2.1 Also included as part of Footnote 1, at the option of the committee, may be a brief description of the current revision. For example, Method D 1020 states: "In 1961, the title, Sections 1, 2, 4, and 5.1, 5.3, and Section 7 were revised in order to extend the method to butane-butene mixtures and eliminate the restriction on butadiene concentrations in the sample."

A24.3 *Literature References*—Use footnotes for references if there are fewer than five. For five or more see Section A23, observing the limitations noted therein. Also see Section G33.

A24.4 *Sources of Apparatus*—Where apparatus may be special or not readily available from more than one or two sources, these sources may be referenced. (However, see Section F4 for detailed rules).

A24.5 *Research Reports*—Reference in a footnote the availability of Research Reports (see Section A27).

A25. Notes

A25.1 Notes in the text shall not include mandatory requirements. Notes are intended to set explanatory material apart from the text itself, either for emphasis or for offering informative suggestions not properly part of the standard. Clarification of the description of required apparatus or procedure and modifications required or permitted in certain cases belong in the test itself. However, text notes may be preferable for detailed description of auxiliary procedures (for example, correction of barometric pressure in a test method not primarily concerned with pressure).

A25.2 Notes appearing in a given standard shall be numbered in sequence except those appended to definitions, which shall be numbered in sequence only under each definition. These notes should preferably appear at the end of the paragraph to which they pertain. If it is desired to refer to a text note in connection with a specific word or phrase in the text, that word or phrase should be followed by a reference to the note, "(Note 1)", etc.

A25.3 Notes in the text are preferred for the following:

A25.3.1 To refer to editorial changes made in the text.

A25.3.2 To refer to similar or companion ASTM standards.

A25.3.3 Under "Definitions," to amplify the description of the term or to refer to similar terms that may be confused with those used in the standard. See Part E for detailed guidelines.

A25.3.4 Limitations of the application of the test when not covered in the text.

A25.3.5 Description, if included under "Scope," of experimental means for recognizing cases where the method is not applicable to the material under test.

A25.3.6 Description of additional (not alternative) apparatus, materials, procedures, or calculations that are not actually required; or description of merely recommended forms of construction of required apparatus.

A25.3.7 Explanation, if desired, of the reasons for a certain requirement or direction. If brief, include in the text rather than as a note.

A25.4 *Patent Disclaimer of Liability*—See Section 15 of the Regulations Governing ASTM Technical Committees. This note, quoted in Section F3.2 and not numbered, is generally placed at the end of the standard. Questions regarding the applicability of this section should be referred to the Staff Manager of your committee.

A25.5 *General Statement of ASTM Policy*—This note, quoted in Section F2.3 and not numbered, is generally placed at the end of the standard after the note on Patent Disclaimer of Liability.

A26. Adjuncts

A26.1 Occasionally it is not practicable to publish as an integral part of the standard, because of its nature, material that may be required for use of the standard. Such material is published as an adjunct. Adjuncts may take the form of:

A26.1.1 Comparison standards such as the copper strip corrosion standards for Method D 130 (photolithed aluminum strips) (Vol 05.01),

A26.1.2 Charts such as the viscosity-temperature charts for liquid petroleum for D 341 (Vol 05.01),

A26.1.3 Reference radiographs such as E 155 (Vols 02.02 and 03.01),

A26.1.4 Books such as the twelve volumes of D 1250, Petroleum Measurement Tables (Vol 05.01), and

A26.1.5 Drawings such as detailed drawings for the construction of the smoke chamber in Test Method D 2843 (08.02).

A26.2 When adjunct material is indicated, it must be made available before publication of the standard.

A26.3 Include all referenced adjuncts in the Referenced Documents section (see A6).

A27. Research Reports

A27.1 Where numerical data have been generated during the development of an ASTM standard or numerical data are used to establish the precision of a test method, or both, a research report is required. The research report shall include raw data, statistical treatment of data, treatment of outliers, etc. A format for the research report is available from Headquarters. Place the research report on file at ASTM Headquarters. It will be assigned a number at the time of main committee ballot and a copy will then be available upon request. Place a footnote in the standard stating that a copy of the research report is available, giving the "RR" designation number. The data used to generate the research report will then be included. A person utilizing an ASTM test method may wish to compare results to those of the originating committee. The availability of the data increases both the usefulness and credibility of the test method.

A28. Index Terms

A28.1 List appropriate terms for indexing, selected from both the title and body of the document and including general, vernacular, and trade terms. These terms will be the basis for preparing the final index terms as defined for style and correctness by committees and staff. Index terms shall be listed at the end of the draft standard and will not appear in the published document unless specifically requested by the committee.

A29. Rationale (Commentary)

A29.1 The inclusion of a rationale (commentary) section in ASTM standards is encouraged to ensure that brief and concise documentation is available to the user of the standard and to provide traceability and clarification of past actions. This documentation might include: (*1*) a brief history of the development of a new standard or revision to an existing standard including when and why the effort was initiated, (*2*) reasons and justification for requirements, (*3*) documentation of factors considered, and (*4*) listing of technical sources and literature.

A29.2 If included, this information should appear in an appendix of the standard.

A29.3 Examples of standard that include sections on rationale:

E 84, Test Method for Surface Burning Characteristics of Building Materials (Vol 04.07)

F 746, Test Method for Pitting or Crevice Corrosion of Metallic Surgical Implant Material (Vol 13.01)

PART B
FORM OF ASTM SPECIFICATIONS

INTRODUCTION

The broad scope of ASTM which covers materials, products, systems, and services, and the need to provide for a variety of approaches to the writing of ASTM specifications, prevent the development of a single document or a series of documents which list all subjects to be covered in all ASTM specifications. This document, however, is intended to provide considerable guidance to the committees in their specification-writing activities.

Special instructions with respect to the legal aspects must be adhered to in writing any standard. These include such matters as contractual items, caveat statements, and patents. See Part F for details.

When a standard is being developed, the costs associated with its development and subsequent use generally should be taken into account. The prime objective should be the optimum use of resources to achieve satisfactory definition of the product or service. However, it should be noted that when the standard relates to the safety of persons, cost considerations are likely to become much less important than when attributes of materials or products are involved. Some standards, such as definitions, impose no cost on the user; others that include numerous and extensive requirements can entail significant expense to users of the standard. The requirements to be included should, therefore, be those that are technically relevant and yield benefits commensurate with the cost of their determination.

Cost effectiveness statements or rationale may be included within a standard if appropriate, usually in an appendix.

Standards or sections of standards relating to the *safe use* of consumer products (Note B1) may be sent to Committee F-15 for review and comment at some appropriate stage prior to letter ballot of the originating main committee. This review is offered by Committee F-15 to provide for the maximum of consumer input. Draft standards submitted to Committee F-15 will receive rapid and constructive critique.

NOTE B1—Consumer products are those designed primarily for use by the consumer in and around the home, school, or recreational areas.

B1. Functions

B1.1 Specifications (see definition on p. vi) may have three functions and, although many specifications serve all three, it is well that those drafting specifications keep these functions in mind so that the primary purposes are not confused.

B1.1.1 *Purchasing*—Specifications facilitate dealings between the purchaser and the supplier. Sufficient requirements should be included to ensure that all batches, lots, or deliveries from any seller that conform to the specification will be satisfactory to the purchaser. Unnecessary requirements are likely to increase costs and should be avoided.

B1.1.2 *Standardization*—Standardization is an inevitable by-product of most specifications. In some cases it may be the primary function. Standardization involves a deliberate and possibly arbitrary choice of a limited number from the multiplicity of qualities, sizes, compositions, etc., that may be available.

B1.1.3 *Providing Technical Data*—All specifications contain technical information, but in some cases the designer requires more information than that provided for purchase or standardization. Committees may add information of this type to specifications either as requirements or as appendixes.

B1.2 *Open-End Agreements*—There shall be no statements in specifications that allow agreement between purchaser and supplier to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits.

B2. Subject Headings of Text

B2.1 The list below shows in sequence subjects covered in specifications. All subjects will not be required for all specifications. The subjects covered in a specification will depend upon the type of specification being written. In some instances there may be need to include sections on subjects other than those shown here.

*Title
Designation
*Scope
Referenced Documents
Terminology
Classification
Ordering Information
Materials and Manufacture
Chemical Composition
Physical Properties
Mechanical Properties
Performance Requirements
Other Requirements
Dimensions, Mass, and Permissible Variations
Workmanship, Finish, and Appearance
Sampling
Number of Tests and Retests
Specimen Preparation
†Test Methods or Analytical Methods
Inspection
Rejection and Rehearing
Certification
Product Marking
Packaging and Package Marking
Supplementary Requirements
Special Government Requirements
Quality Assurance
Annexes and Appendixes
References

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*The headings marked with an asterisk (*) are required in all ASTM specifications.

†Test methods included must contain the mandatory headings shown in Section A1.

B2.2 Subject headings in boldface type shall precede each section to orient the reader. Substitute text divisions and number in accordance with the Guide for the Use of the Modified Decimal Numbering System in Part D of this publication. Examples of typical specifications are shown in the Appendix.

B3. Title

B3.1 The title should be as concise as possible but complete enough to identify the material, product, system, or service covered by the specification. Titles are used in lists, table of contents, and indexes, and it is most important that they be brief but inclusive. Use the singular form: "specification."

B4. Designation and Year of Issue

B4.1 *Designation*—The ASTM designation, assigned by Headquarters on submittal for approval, consists of the following sequential parts:

B4.1.1 A letter designation denoting in general the classification according to material, product, system, or service:

A—Ferrous metals and products
B—Nonferrous metals and products
C—Cementitious, ceramic, concrete, and masonry materials
D—Miscellaneous materials and products
E—Miscellaneous subjects
F—End-use materials and products
G—Corrosion, deterioration, weathering, durability, and degradation of materials and products
ES—Emergency standards
P—Proposals

B4.1.2 A sequential number following the letter designation (see also B4.4).

B4.1.3 The letter "M" following the alphanumeric designation (B4.1.1 and B4.1.2) indicates that acceptable metric units are included in this document as a standard unit of measurement (see also B4.4).

B4.2 *Year of Issue*

B4.2.1 After the designation, a hyphen is followed by the last two numbers of the year of acceptance or of last revision. If the standard is revised again during the same year, this is indicated by adding an "a" for the second revision, "b" for the third revision, etc.

B4.2.2 The parenthetical phrase "(Reapproved 19__)" to designate the year of last reapproval of a standard, if applicable.

B4.2.3 For editorial changes that do not change the year designation, a note is inserted before the text to indicate the location and date of the change and a superscript epsilon (ε) is added after the year designation. The epsilon designations and corresponding notes are numbered chronologically and are deleted upon occasion of the next revision or reapproval.

B4.3 Designation numbers of standards that have been discontinued will not be reassigned.

B4.4 *"M" Standards* (see also H2).

B4.4.1 *Companion Standards*—If a standard is written in acceptable metric units and has a companion standard written in inch-pound units (or other units), the metric standard is identified by adding the letter "M" immediately after the sequential alphanumeric designation of the companion document. For example, A 109M is the designation for the metric companion of A 109. No significant technical differences shall exist between an "M" standard and the corresponding companion standard; each is to provide equivalent results. When companion standards exist, each standard should contain a text note acknowledging the existence of the other. The wording of the text in the scope of an inch-pound standard might be:

> 1.X—A complete metric companion to Specification A 000 has been developed—A 000M; therefore, no metric equivalents are shown in this specification.

The wording of the scope text in a metric standard might be:

> 1.Y—This specification is the metric companion of Specification A 000.

B4.4.2 *Combined Standards*—If the standard is written in inch-pound units (or other units) and acceptable metric units, the document is identified by a dual alphanumeric designation, for example, A 109/A 109M. The wording of the text in the scope of the combined standard might be:

> 1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

B5. Scope (Required)

B5.1 The scope should amplify the title, state the function of the specification, and note any materials, products, systems, or services excluded. Trademarks should not be used. It is also desirable to include a statement in this section as to whether inch-pound or SI units shall be used in referee decisions (see H4.3 Use of Metric (SI) Units in ASTM Standards, Part H of this publication).

NOTE B2—Reference to *alternative, companion,* or *related* standards may be included in a note in the scope. The title and designation of such standards shall be included in the Referenced Documents section.

B5.1 Include in this section the caveat on safety hazards if one or more test methods are detailed other than by reference. The caveat shall be preceded by the following statement: "The following *safety hazards caveat* pertains only to the test method described in this specification." (See Section F2.1.)

B6. Referenced Documents

B6.1 List in alphanumeric sequence the designation and complete title of the following documents referenced within the standard: ASTM standards, proposals, and adjuncts; and standards and codes of other organizations. For references to all other documents, including ASTM STPs, use the format indicated in Section G33.

B6.2 Provide footnotes to this section to indicate the sources of these documents. When ASTM standards are referenced later in the text, use only the type of standard (that is, specification, test method, practice, classification, guide, terminology, etc.) and the designation letter and number (for example, Test Method D 1310).

B6.3 The designations of referenced documents should not include the year of issue since they are subject to revision without relation to the parent standard, and dates of publication do not necessarily coincide with approval dates.

B6.4 When listing referenced adjuncts, provide a brief description in this section, and a footnote of the availability. (For more specific information on adjuncts, refer to Section B29.)

B7. Terminology (see also Part E)

B7.1 If applicable, refer to existing ASTM definitions standards having general applications.

B7.1.1 Examples of ASTM definitions standards having general application are:

D 8, Definitions of Terms Relating to Materials for Roads and Pavements (Vol 04.02)
D 123, Definitions of Terms Relating to Textiles (Vols 07.01 and 07.02)
D 883, Definitions of Terms Relating to Plastics (Vol 08.01)

B7.2 *Definitions*—Any terms defined in the specification must be in dictionary-definition form, following the guidelines of Part E of this publication. If desirable, repeat here applicable definitions from a definitions standard.

B7.2.1 Examples of ASTM specifications incorporating definitions are:

B 188, Specification for Seamless Copper Bus Pipe and Tube (Vol 02.01)
C 494, Specification for Chemical Admixtures for Concrete (Vol 02.01)

B7.3 *Descriptions of Terms Specific to This Standard*—Definitions that are specific only to the standard shall appear under this heading.

B7.3.1 Examples of ASTM specifications incorporating descriptions of terms specific to the given standard are:

D 1760, Specification for Pressure Treatment of Timber Products (Vol 04.09)
F 589, Consumer Safety Specification for Non-Powder Guns (Vol 15.07)

B7.4 *Symbols*—In a standard with many equations containing quantity symbols, it may be convenient to list all of the symbols in this section rather than under each equation.

B8. Classification

B8.1 When more than one material, product, or system is specified, they may be separated first by *types*, which are distinguished by roman numerals. This first subdivision shall be based upon some major property, composition, or application of the item. Designate further subdivision by *grades* according to some pertinent property or properties and identify by arabic numbers. If necessary, make additional division into *classes*, identified by capital letters.

NOTE B3—The precedence of type, grade, and class, as well as the method of designation, is the ASTM preferred style; it should be used in the absence of any established preference.

B8.2 When a type, grade, or class has been deleted, do not use this designation again, to avoid confusion with earlier specifications. If new designations are used, they must be of different format and preferably followed (for a limited time) by the previous designation in parentheses.

B9. Ordering Information (See also Section B24)

B9.1 When the specification covers options for purchase, such as various types, grades, classes, alloys, sizes, mass, etc., the purchase order or inquiry should state which particular types, alloys, sizes, etc., are desired.

B9.2 A listing of each such optional feature, together with a reference to the applicable section of the specification, will be of assistance in the wording of orders. After the attention of the purchaser is directed to all of the options in the specification, his attention might be directed to what would be furnished by the supplier if the purchaser fails to specify one or more of the options.

B9.3 It is recommended that this section be included in all specifications as a checklist of items to be included in a purchase order or contract. If this list includes the ASTM designation, it is desirable to include "and year of issue" to avoid misunderstandings between contractual parties.

B10. Materials and Manufacture

B10.1 General requirements regarding the materials and methods of manufacture to be used are frequently included, particularly when these may include reference to any particular processes of manufacture, such as the open-hearth, electric-furnace, or basic-oxygen bessemer processes generally specified for steel products. When the material, product, or system specified is made from two or more materials or products, this section should state briefly the general requirements of the materials or products to be used and the process to be followed in manufacture, including items such as the nature and character of any alloys, fillers, saturants, antioxidants, coatings, and plasticizers.

B11. Chemical Composition

B11.1 When necessary, detailed requirements should be given as to chemical composition and other chemical characteristics to which the material, product, or system must conform. Frequently these are presented in tabular form. It is most important that the following information be clearly indicated: (*1*) name of each constituent specified, (*2*) whether the requirement is a maximum, minimum, or range, (*3*) whether an allowance for measurement error is incorporated in these limits, (*4*) the units applicable, (*5*) references to notes or footnotes when necessary for further clarification, and (*6*) appropriate analytical methodology.

B11.2 The sequence of items specified should be consistent within a related group of specifications.

B11.3 The preferred introduction for this section is: "The material shall conform to the requirements prescribed in Table 1."

B11.4 *Limits on Nonspecified Elements*—It is suggested that the following statement be added to tables of chemical requirements as applicable, to replace the requirements and statements presently being used regarding nonspecified elements: "By agreement between purchaser and supplier, analysis may be required and limits established for elements or compounds not specified in the table of chemical composition." (See also Section B24.)

B12. Other Requirements

B12.1 When necessary, detailed requirements should be given as to characteristics to which the material, product, or system must conform. Frequently these are presented in tabular form. It is most important that the following information be clearly indicated: (*1*) name of each property or requirement, (*2*) whether the requirement is a maximum, minimum, or range, (*3*) whether an allowance for measurement error is incorporated in these limits, (*4*) the units applicable, (*5*) references to notes or footnotes when necessary for further clarification, and (*6*) appropriate test methodology.

B12.2 *Physical Properties*—Present the requirements for electrical, thermal, optical, and similar properties in this section, usually in tabular form.

B12.3 *Mechanical Properties*—Present the requirements for tensile strength, yield strength, elongation, and similar properties in this section.

B12.4 *Performance Requirements*—Include functional, environmental, and similar requirements in this section when necessary.

B12.5 *Other Requirements*—Include additional requirements as needed.

NOTE B4—In preparing a specification it is essential to make sure that there is a test procedure for determining conformance for each requirement. These must be listed in the specification (see Section B18).

B12.6 When it is not feasible to tabulate the requirements, separate text division may be used to specify the various requirements. These should be given appropriate headings consistent with the subject matter included.

B13. Dimensions, Mass, and Permissible Variations

B13.1 Details as to the standard shapes, mass, and size ranges usually are presented best in tabular form with brief reference in the text. Separate sections may be necessary with individual tables. The tables should clearly indicate where the various size ranges are divided, for example, ranges from 0 to 250 mm, 250 to 500 mm, 500 to 750 mm should be more properly stated as 250 mm and under; over 250 to 500 mm, inclusive; over 500 to 750 mm, inclusive, etc.

B13.2 The permissible variations in dimensions, mass, etc., frequently can be included in the same tables with the nominal sizes. It should be made clear whether the tolerances specified are both plus and minus or apply in only one direction.

B14. Workmanship, Finish, and Appearance

B14.1 Requirements covering the workmanship and finish include such general requirements as the type of finish and general appearance or color, uniform quality and temper (for metals), and whether the item is clean, sound, free of scale and injurious defects. To avoid misunderstanding, these should be spelled out clearly. Provisions for removal or repair of minor surface imperfections that are not considered cause for rejection should be stated.

B14.2 For products such as pipe and tile it is usually customary to specify absence of defects such as fractures, large or deep cracks, checks, blisters, laminations, and surface roughness. The finish and shape of the ends also should be specified.

B15. Sampling

B15.1 If a specification applies to a unit of product or material such as a piece of cloth, a coil of wire, a section of plastic pipe, or a heat of steel, from which specimens are to be taken for testing, the procedure for obtaining these specimens should be described.

B15.2 If a specification pertains to individual units of a lot and sampling inspection is likely to be the normal procedure, it is desirable for the specification to reference or include in a supplementary section a sampling procedure for determining acceptability of the lot. (See Section B24.3.)

NOTE B5—In a single sampling plan by attributes the acceptability of a lot will be determined by the number of units of product in the sample that do not conform to the specifications. The acceptable quality level (AQL) and limiting quality level (LQL) of an acceptance sampling plan, expressed as percentages of the units nonconforming, are characteristics of the sampling plan and are not to be viewed as product specifications.

B15.3 If a specification pertains to the mean of a lot, in particular to the mean of a lot of bulk material, such as cement or pig iron, the procedure for sampling the lot or the formation of sample test units, or both, should be described or referenced. The criterion for determining conformance of the lot should be specifically stated.

B15.4 If a specification applies to a lot of bulk material, state the number of increments required to create a sample test unit and the number of test units to be taken to determine conformance of the lot.

B15.5 The minimum amount of material required to carry out conveniently all the tests in the specification should be indicated for the convenience of the user of the specification.

B16. Number of Tests and Retests

B16.1 State the number of test units and the number of test specimens or subunits that are required to determine conformance of the material or product to the specifications. In the sampling of a lot of bulk material, state the size of the sample in terms of the number of primary (first stage) sampling units that is required to determine conformance to the specifications.

NOTE B6—When a specification pertains to several different properties of a material to be determined by a variety of test methods, a test unit is defined as a unit or portion of the material that is sufficient to obtain a single, adequate set of test results for all properties to be measured.

B16.2 If a specification allows retesting in cases where the material or product fails to pass the specification, state the rules for the retesting and the conditions under which the retesting shall be permitted.

B17. Specimen Preparation

B17.1 Where special preparation is required, as for example in specifications for molding materials, this section should be included.

B17.2 Refer to a standard test method if possible.

B17.3 If no standard test method exists, include sufficient detail in the specification to assure acceptable reproducibility of test results.

B17.4 State that specimens are to be prepared in accordance with the recommendations of the manufacturer only if neither B17.2 or B17.3 is feasible.

B18. Test Methods or Analytical Methods

B18.1 List standard test methods for measurement of all requirements of a specification. Refer to the ASTM test methods used in testing the material to determine conformance with the specification. This includes sampling, chemical analysis, mechanical, electrical, thermal, optical, and other testing procedures. When alternative procedures are given in the test methods, it is important to state which particular procedure shall be used as the basis for the specification requirement.

B18.2 When there is no ASTM test method specified for a particular quality or property of a specified material, describe the test procedure to be followed in detail in the specification, following the Form of ASTM Test Methods (Part A of this publication). Include all mandatory information listed in A1.1 (title, scope, significance and use, procedure, precision and bias).

B18.3 Where a method of some other organization is being used and the committee has not approved the test as an ASTM test method, then it is preferable to describe the test in detail in the specification and to include a footnote reference to the original source. Appropriate copyright releases must be obtained.

B18.4 State all procedures in the imperative mood.

B19. Inspection

B19.1 The following statement has been adopted by the Board of Directors to be used when there is a substantial disagreement between producers and users within a particular committee, resulting in a blockage of progress in the acceptance of new specifications or revisions to specifications:

> Inspection of the material shall be agreed upon between the purchaser and the supplier as part of the purchase contract.

B19.2 Place any technical requirements on inspection such as sampling plan and physical or mechanical properties in other appropriate parts of the specification.

B20. Rejection and Rehearing

B20.1 The following statement serves as a guide to ASTM committees when there is need for a section on rejection and rehearing:

> Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

B21. Certification

B21.1 If a certification section is included, the section should read:

> When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

B21.2 Upon the request of the purchaser in the contract or order, the certification of an independent third party indicating conformance to the requirements of this specification may be considered.

B22. Product Marking

B22.1 It is customary to specify the information to be marked on the material or included on the package, or on a label or tag attached thereto. Such information typically may include the name, brand, or trademark of the manufacturer, quantity, size, weight, ASTM designation, or any other information that may be desired for a specific material.

B23. Packaging and Package Marking

B23.1 When it is customary and desirable to package, box, crate, wrap, or otherwise protect the item during shipment and storage in accordance with a standard practice, it is customary to state the requirements.

B24. Supplementary Requirements

B24.1 For some standards supplementary requirements may be specified. Usually these apply only when specified by the purchaser in the inquiry, contract, or order. A statement to this effect shall appear in the first paragraph of the Supplementary Requirements section. The following is a suggested statement relating to special requirements:

> The following supplementary requirements shall apply only when specified by the purchaser in the contract or order.

B24.2 Supplementary requirements shall appear separately in a Supplementary Requirements section.

B24.3 *Quality Assurance*—This requirement, if included, shall be qualified by the statement: "When specified in the contract or purchase order." Reference to a suitable document, such as ASTM, ANSI, MIL, etc., may be made by agreement between the supplier and the purchaser.

B24.4 *Qualification*:

B24.4.1 Qualification to non-government standards will be based on the same justification and operated under the same rules as qualification to military or federal specifications. The justification and rules are covered in the DoD 4120.3-M manual, Chapter 4. Briefly, qualification is justified when one or more of the following apply: (*1*) The time to conduct one of the tests exceeds 30 days, (*2*) conformance inspection will require special equipment, (*3*) specification covers life survival or emergency life-saving equipment. The committee preparing the specification that will call for qualification will be asked to show that: (*1*) there is no other practical way of obtaining evidence of the availability of products to meet the specification in a reasonable time independent of that acquisition and (*2*) two or more sources are available and willing to submit their products for qualification.

B24.4.2 When qualification is determined to be feasible and necessary, it will be included in the Supplementary Requirements section with wording similar to:

> Items furnished under this specification shall be products that are qualified for listing on the applicable qualified products list at the time set for opening of bids.

Qualification testing (as distinct from acceptance testing) must be specifically identified with accept/reject criteria. A statement must be made concerning retention of qualification. This may either be a manufacturer's periodic self-certification, a periodic submission of test results, or a complete retest of the product. A statement similar to the following must be included:

> With respect to products requiring qualification, awards will be made only for products that are, at the time set for opening of bids, qualified for inclusion in Qualified Parts List (QPL No.) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Parts List is (insert name and address of qualifying organization(s)) and information pertaining to qualification of parts may be obtained from that activity.

B25. Annexes and Appendixes

B25.1 Additional information may be included in one or more annexes or appendixes to the specification.

B25.2 The words "Mandatory Information" shall be included directly under the title of annexes and the words "Nonmandatory Information" shall be included directly under the title of appendixes.

B25.3 *Annexes*—Include in annexes any detailed information such as that on apparatus or materials that is a mandatory part of the specification but too lengthy for inclusion in the main text. Annexes shall precede appendixes.

B25.4 *Appendixes*—There are times when it is desirable to include in a specification additional information for general use and guidance, but which does not constitute a mandatory part of the specification. It is appropriate to include such informational material in appendixes. Examples of material that has been included in such appendixes are tables showing approximate relationship between tensile strength and hardness, list of preferred thickness of plate, sheet, and strip reproduced from other documents, tables of standard mass and standard sizes, information on typical applications of the material covered, and information on typical physical properties whose definite values are not prescribed in the specification.

B26. References

B26.1 Include only references to publications supporting or providing needed supplementary information. Historical and acknowledgment references are not recommended. If there are five or more references, list them in an unnumbered section at the end of the specification in the order in which they appear in the text. If there are fewer than five literature references, use footnotes (see Section G33).

B27. Footnotes

B27.1 *General*—Footnotes referenced in the text are intended only for reference and should never include any information or instructions necessary for the proper application of the specification. Table footnotes are a part of the table. Use consecutive superior numerals for reference to footnotes except in connection with tables, in which case use italic capital letters.

B27.2 *Committee Jurisdiction and History*—Footnote 1 shall include in the first paragraph the committee having jurisdiction and, where the committee so requests, the subcommittee. The second paragraph shall include history information as follows: (*1*) approval date of latest revision, (*2*) month and year of publication, (*3*) designation and year of original issue, (*4*) designation and year of previous issue, and (*5*) information as to the other standards that may have been replaced by the standard, year of redesignation, etc.

B27.2.1 Also included as part of Footnote 1, at the option of the committee, may be a brief description of the current revision. For example, Specification B 111 could state: In 1980 new Copper UNS Nos. C10100, C61300, and C61400 were added and the expansion test was revised to refer to Test Method B 153.

B27.3 *Literature References*—Use footnotes for references if there are fewer than five. For five or more see Section B26, observing the limitations noted therein. Also see Section G33.

B27.4 *Sources of Apparatus*—Where apparatus may be special or not readily available from more than one or two sources, these sources may be referenced. (However, see Section F4 for detailed rules.)

B27.5 *Research Reports*—Reference in a footnote the availability of research reports (see Section B30).

B28. Notes

B28.1 Notes in the text shall not include mandatory requirements. Notes are intended to set explanatory material apart from the text itself, either for emphasis or for offering informative suggestions not properly part of the standard. Clarification of the description of required apparatus or procedure and modifications required or permitted in certain cases belong in the text itself. However, text notes may be preferable for detailed description of auxiliary procedures (for example, correction of barometric pressure in a test method not primarily concerned with pressure). Table notes are a part of the table and are mandatory provisions.

B28.2 Number notes appearing in a given standard in sequence except those appended to definitions, which shall be numbered in sequence only under such definition. These notes should preferably appear at the end of the paragraph to which they pertain. If it is necessary to refer to a text note in connection with a specific word or phrase in the text, that word or phrase should be followed by a reference to the note, "(Note 1)," etc.

B28.3 Notes in the text are preferred for the following:

B28.3.1 To refer to editorial changes made in the text.

B28.3.2 To refer to similar or companion ASTM standards.

B28.3.3 Under "Definitions," to amplify the description of the term or to refer to similar terms that may be confused with those used in the standard. See Part E for detailed guidelines.

B28.3.4 Description, if included under "Scope," of experimental means for recognizing cases where the method is not applicable to the material under test.

B28.3.5 Description of additional (not alternative) apparatus, materials, procedure, or calculations that are not actually required; or description of merely recommended forms of construction of required apparatus.

B28.3.6 Explanation, if needed, of the reasons for a certain requirement or direction. If brief, include in the text rather than as a note.

B28.4 *Patent Disclaimer of Liability*—See Section 15 of the Regulations, Governing ASTM Technical Committees. This note, quoted in Section F3.2 and not numbered, is generally placed at the end of the standard. Questions regarding the applicability of this section should be referred to the Staff Manager of your committee.

B28.5 *General Statement of ASTM Policy*—This note, quoted in Section F2.3 and not numbered, is generally placed at the end of the standard after the note on Patent Disclaimer of Liability.

B29. Adjuncts

B29.1 Occasionally it is not practicable to publish as an integral part of the standard, because of its nature, material that may be required for use of the standard. Such material is published as an adjunct. Adjuncts may take the form of:

B29.1.1 Comparison standards such as the copper strip corrosion standards for Method D 130 (photolithed aluminum strips) (Vol 05.01).

B29.1.2 Charts such as the viscosity-temperature charts for liquid petroleum for D 341 (Vol 05.01).

B29.1.3 Reference radiographs such as E 155 (Vols 02.02

and 03.01),

B29.1.4 **Books** such as the twelve volumes of D 1250, Petroleum Measurement Tables (Vol 05.01), and

B29.1.5 **Drawings** such as detailed drawings for the construction of the smoke chamber in Method D 2843 (08.02).

B29.2 When adjunct material is indicated, it must be made available before publication of the standard.

B29.3 Include all referenced adjuncts in the Referenced Documents section (B6).

B30. Research Reports

B30.1 Research reports, which include historical or round-robin information, or other data, should be sent to Headquarters, where they are given a file number and made available upon request. Such reports may be referenced in a footnote (see B27.5). If the specification contains a detailed test method, the requirements in Section A27 apply.

B31. Index Terms

B31.1 List appropriate terms for indexing, selected from both the title and body of the document and including general, vernacular, and trade terms. These terms will be the basis for preparing the final index terms as defined for style and correctness by committees and staff. Index terms shall be listed at the end of the draft standard and will not appear in the published document unless specifically requested by the committee.

B32. Rationale (Commentary)

B32.1 The inclusion of a rationale (commentary) section in ASTM standards is encouraged to ensure that brief and concise documentation is available to the user of the standard and to provide traceability and clarification of past actions. This documentation might include: (*1*) a brief history of the development of a new standard or revision to an existing standard including when and why the effort was initiated, (*2*) reasons and justification for requirements, (*3*) documentation of factors considered, and (*4*) listing of technical sources and literature.

B32.2 If included, this information should appear in an appendix of the standard.

B32.3 Examples of standards that include sections on rationale:

E 84, Test Method for Surface Burning Characteristics of Building Materials (Vol 04.07)
F 746, Test Method for Pitting or Crevice Corrosion of Metallic Surgical Implant Material (Vol 13.01)
F 763, Practice for Short-Term Screening of Implant Material (Vol 13.01)

B33. Part Numbering

B33.1 *General*—Part-numbering systems may be included in an ASTM specification. The part-numbering system shall be placed in the appendix, shall be called out "when specified" as a supplementary requirement, and shall be referred to appropriately under either "product marking," "packaging and package marking," or both places.

B33.2 *When Used for DoD Procurement*:

B33.2.1 The inclusion of a part-numbering system should be considered by technical committees when preparing specifications. Although it is a committee decision whether or not to include part numbering, ASTM encourages such inclusion in specifications to make them more readily usable directly in procurement and supply applications.

B33.2.2 Part numbers shall be kept short and shall not exceed 15 characters. Part numbering shall be uniform for all parts covered by the same specification; uniformity is also preferred for all part numbers within the same group of closely related items.

B33.3 *Criteria for Inclusion of Part Numbers*:

B33.3.1 In development of standards that embrace end products, every attempt shall be made to define all product variables so as to enable one product to be positively distinguished from another (from both an engineering and stocking viewpoint). Each product so covered shall be assigned a part number that:

- Is uniquely identifying.
- Includes the document (standard) number.
- Does not exceed 15 characters including dashes, slashes, spaces, etc.
- Does not include the letters "I", "O", "Q", "S", "X", and "Z".
- Does not change when the document is changed in a manner that does not affect interchangeability.
- Does change when product is modified so as to not be interchangeable. (In such instances, appropriate usage guidance will be provided if appropriate.)

B33.3.2 All standards that include part numbers shall contain a five-digit numerical manufacturers' code as assigned by the U.S. Government under the Federal Cataloging Program.

B33.3.3 An example of a part-numbering system is as follows:

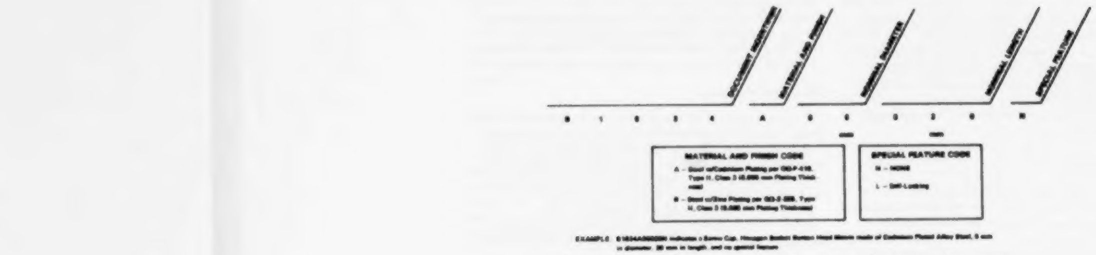
DOCUMENT IDENTIFIER
MATERIAL AND FINISH
NOMINAL DIAMETER
NOMINAL LENGTH
SPECIAL FEATURE
MATERIAL AND FINISH CODE
SPECIAL FEATURE CODE
N – NONE
L – Self-Locking
EXAMPLE:

FIG. B1 Part Numbering System Covering Standard Items Used by U.S. Government

PART C
FORM OF OTHER TYPES OF ASTM STANDARDS

INTRODUCTION

In addition to test methods and specifications, ASTM standards take other forms, including the following:

- Classifications
- Practices and Guides
- Terminology or Definitions (see Part E)
- Reference Radiographs
- Reference Photographs
- Tables
- Charts

As a committee attempts to develop a standard, the question of differentiation between a practice and a guide may arise. In general, a practice underscores a general usage principle whereas a guide suggests an approach. A standard practice connotes accepted procedures for the performance of a given task. Refer to definitions given on p. vi. A guide may propose a series of options or instructions that offer direction without recommending a definite course of action. The purpose of this type of standard is to offer guidance based on a consensus of viewpoints but not to establish a standard practice to follow in all cases. A guide is intended to increase the awareness of the user concerning available techniques in a given subject area, while providing information from which subsequent testing programs can be derived.

Regarding reference radiographs, reference photographs, tables, and charts, there are relatively few subject headings, and the form of the standard is left to the jurisdiction of the sponsoring committee. The first two types listed in the introduction to Part C, however, are most common and are given greater treatment below.

Special instructions with respect to the legal aspects must be adhered to in writing any standard. These include such matters as contractual items, caveat statements, and patents. See Part F for details.

When a standard is being developed, the costs associated with its development and subsequent use generally should be taken into account. The prime objective should be the optimum use of resources to achieve satisfactory definition of the product or service. However, it should be noted that when the standard relates to the safety of persons, cost considerations are likely to become much less important than when attributes of materials or products are involved. Some standards, such as definitions, impose no cost on the user; others that include numerous and extensive requirements can entail significant expense to users of the standard. The requirements to be included should, therefore, be those that are technically relevant and yield benefits commensurate with the cost of their determination.

Cost effectiveness statements or rationale may be included within a standard if appropriate, usually in an appendix.

CLASSIFICATIONS

C1. Description

C1.1 "A classification is a systematic arrangement or division of materials, products, systems, or services, into groups based on similar characteristics such as origin, composition, properties, or use."[1]

C1.2 Classifications provide a time- and space-saving shorthand for specifying the above description.

C1.3 Classifications will be defined by each committee differently because of the unique nature of that committee. A collection or grouping of definitions to one committee may be termed a classification while still another committee may group objects or properties in a classification.

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[1] From *Regulations Governing ASTM Technical Committees*.

C2. Subject Headings of Text

C2.1 The following list shows in sequence the subjects usually covered in a classification. Not all of these headings may be required for a particular classification. Also, it may be necessary to use other appropriate headings in classifications covering specialized subjects. These should appear in the most appropriate place and sequence depending on their relation to the sections listed below:

* Title
Designation
* Scope
Referenced Documents
Terminology
* Significance and Use
* Basis of Classification
Test Methods and Retest

---

* The headings marked with an asterisk (*) are required in all classifications.

C3. Title

C3.1 The title of a classification standard should be concise, but complete enough to identify the nature of the basis for classification, for specific materials, systems, services, and products.

C4. Designation

C4.1 The ASTM designation will be assigned by Headquarters on submittal for approval. Refer to Sections A3 or B4 for sequential parts of numbering.

C5. Scope

C5.1 Information should be provided here as to the purpose and application of the classification.

C5.2 Any comments as to the limitation of the classification should be made in the scope.

C6. Referenced Documents

C6.1 List here in alphanumeric sequence the designation number and complete title of all documents referenced within the classification. Refer to Sections A6 and B6 for further information.

C7. Terminology (See also Part E)

C7.1 *Definitions* must be in dictionary-definition form, following the guidelines of Part E of this publication. If applicable, refer to existing ASTM definitions standards having general applications. If desirable, repeat here applicable definitions from a definitions standard.

C7.2 *Definitions of Terms Specific to This Standard*—List under this heading definitions that are specific (or applicable) only to the given standard.

C7.3 *Symbols*—In a standard with many equations containing quantity symbols, it may be convenient to list all of the symbols in this section rather than under each equation.

C8. Significance and Use

C8.1 Include in this section, information as to the application of the classification. How and when should the classification be used and by whom?

C8.2 A warning as to the restrictions of the classification should be made. "This classification is not meant to ——."

C9. Basis of Classification

C9.1 The basis of classification is in fact the most important portion of the document. This heading sets up categories in which groupings will be made. For example, ASTM standard classification of coals (D 388) by rank defines classification of higher rank coals according to fixed carbon on a dry basis while lower rank coals are classed according to caloric value on the moist basis.

C10. Test Methods and Retest

C10.1 Properties enumerated in a classification may be determined in accordance with specific test methods. These methods should be referenced in this portion of the document.

C10.2 Because of variability resulting from sampling and a lack of satisfactory reproducibility, and in instances when the first test results do not conform to the requirements prescribed in this classification, then a retest option may be provided.

C11. Examples

C11.1 Examples of classifications are:

D 388, Classification of Coals by Rank (Vol 05.05)
D 3475, Classification of Child-Resistant Packages (Vol 15.09)

Classification D 388 is included in the Appendix for reference.

PRACTICES (AND GUIDES)

C12. Description

C12.1 "A practice is a definitive procedure for performing one or more specific operations or functions that does not produce a test result."[1] Examples of such include selection, preparation, application, inspection, necessary precautions for use or disposal, installation, maintenance, and operation of testing apparatus.

C12.2 Standard practices give accepted procedures for the performance of a given task.

C12.3 In the past the word "Recommended" was used as an adjective in conjunction with the term "practice." "Recommended Practice" may have connoted something less demanding than standard. Committees may have, in the past, chosen to term many practices as methods to ensure emphasis. Committees now have the opportunity for developing a standard test method, or a standard practice, or a standard guide.

C13. Subject Headings of Text

C13.1 The subject headings and order of sections may be very similar to those utilized in ASTM test methods, but in many cases the normal headings are not pertinent. Listed below are sections that appear common to many standard practices of ASTM technical committees:

* Title
Designation
* Scope
Referenced Documents
Terminology
Summary of Practice
* Significance and Use
Reagents
Procedure
Report
Precision and Bias (for included tests and analyses)
Annexes and Appendixes

---

* The headings marked with an asterisk (*) are required in all practices and guides.

C13.2 In many cases, however, the normal headings are not pertinent. In these cases, begin as usual with a section on Scope and follow in logical sequence the steps to be followed in carrying out the standard practice.

C14. Title

C14.1 The title should be concise but complete enough to identify the nature of the practice. It should identify the subject of application and should be distinguishable from similar titles. (See Section A2.1 as it applies to titles of test methods.)

C15. Designation

C15.1 The ASTM designation will be assigned by Headquarters on submittal for approval. Refer to Sections A3 and B4 for sequential parts of numbering.

C16. Scope

C16.1 Information should be provided herein relating to the purpose and application of the practice.

C16.2 Any appropriate comments as to the limitations of the practice should be made in the scope.

NOTE C1—Reference to *alternative, companion,* or *related* standards may be included in a note in the scope. The title and designation of such standards shall be included in the Referenced Documents section.

C16.3 Include in this section the caveat on safety hazards if the practice or guide involves the use of materials, operations, or equipment (See Section F2.1).

C17. Referenced Documents

C17.1 List here in alphanumeric sequence the designation number and complete title of all standards referenced within the practice (or guide). Refer to Sections A6 and B6 for further information.

C18. Terminology

C18.1 Refer to Section A7 and Part E.

C19. Summary of Practice

C19.1 Include here a brief outline of the practice, describing its essential features without the details that are a necessary part of the complete statement of procedure and sequence. If desired, a brief statement of the principle of the practice may be given.

C20. Significance and Use

C20.1 Included in this section should be information as to the application of the practice, how and when should the practice be used, and by whom? The most significant attributes of the procedure should be detailed.

C20.2 A warning as to the restrictions of the practice should be made. "This practice is not meant to ——————."

C21. Reagents

C21.1 Refer to Section A12.

C22. Procedure

C22.1 Include in the procedure detailed directions for performing the task outlined in the practice.

C22.2 In some cases, to aid in clarity, a diagrammatic, photographic, or schematic assist may be of value to the user of the practice. These must be supplied to the ASTM editorial staff as originals. An excellent example of this type of approach can be seen in ASTM Standard Practice D 2855 for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings (Vol 08.04).

FIG. 7 Cleaning of Pipe with Dry Cloth to Remove Foreign Matter

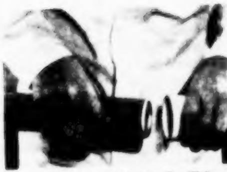


FIG. 8 Pipe Entering Dry Fitting

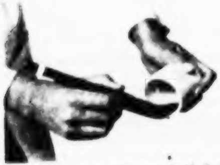


FIG. 9 Application of Primer to Inside Socket Surface

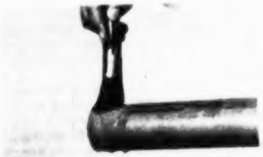


FIG. 10 Liberal Application of Primer to Softer Surface of Male End of Pipe

C23. Report

C23.1 Include detailed information as to calculating, interpreting, and reporting results in this section.

C23.2 Depending upon the nature of the practice, an entire section may, by necessity, be devoted to calculation or interpretation of results, or both.

C23.3 When a practice permits variance in conditions under which the standard practice has been performed, these conditions should become part of the report.

C24. Precision and Bias (for included tests and analyses) (Refer to Section A21)

C25. Annexes and Appendixes

C25.1 Annexes and appendixes play a particularly important role as many committees promulgate standard practices. Supplementary information is provided herein to aid in understanding and utilizing the standard.

C25.2 Annexes (see Section A22.3)

C25.3 Appendixes (see Section A22.4)

C26. Other Subject Headings

C26.1 As previously stated, many section headings, as utilized in ASTM test methods, may or may not be applicable in standard practices.

C27. Index Terms

C27.1 List appropriate terms for indexing, selected from both the title and body of the document and including general, vernacular, and trade terms. These terms will be the basis for preparing the final index terms as defined for style and correctness by editors in committees and staff. Index terms shall be listed at the end of the draft standard and will not appear in the published document unless specifically requested by the committee.

C28. Rationale (Commentary)

C28.1 The inclusion of a rationale (commentary) section in ASTM standards is encouraged to ensure that brief and concise documentation is available to the user of the standard and to provide traceability and clarification of past actions. This documentation might include: (*1*) a brief history of the development of a new standard or revision to an existing standard including when and why the effort was initiated, (*2*) reasons and justification for requirements, (*3*) documentation of factors considered, and (*4*) listing of the technical sources and literature.

C28.2 If included, this information should appear in an appendix of the standard.

C28.3 Examples of standards that include sections on rationale:

E 84, Test Method for Surface Burning Characteristics of Building Materials (Vol 04.07)
F 746, Test Method for Pitting or Crevice Corrosion of Metallic Surgical Implant Material (Vol 13.01)
F 763, Practice for Short-Term Screening of Implant Material (Vol 13.01)

C29. Examples

C29.1 Examples of practices and guides are as follows:

C 903, Practice for Preparing Refractory Concrete Specimens by Cold Gunning
D 4270, Guide for Using Existing Practices in Writing and Developing Test Methods
E 583, Recommended Practice for Systematizing the Development of (ASTM) Voluntary Consensus Standards for the Solution of Nuclear and Other Complex Problems, is a truly unique standard practice. E 583 has been termed a "matrix" standard and indeed may be worthy of special treatment in future revisions of this manual. Matrix standards function as excellent standards development "planning" standards and

may provide excellent guidance and direction (see *Standardization News*, April 1977)

- E 584, Standard Recommended Guide for Developing the (ASTM) Voluntary Consensus Standards Required to Help Implement the National Energy Plan
- F 361, Practice for Assessment of Compatibility of Metallic Materials for Surgical Implants with Respect to Effect of Materials on Tissue, is an example of a standard practice patterned after a test method
- F 499, Practice for Installation of Wood Underlayment and Preparation of the Surface to Receive Resilient Flooring

C29.2 Practice F 499 and Guide D 4270 may be found in the Appendix for direct reference.

SUPPLEMENTARY DOCUMENTS

C30. Committee "White Papers"

C30.1 With the increasing divergence of new ASTM standards-development activities into areas that do not readily conform to "standard" titular or structural areas, an important committee procedure to follow is the establishment of a "white paper" outlining ASTM form and style and detailing variance when necessary. This "white paper" becomes part of the documentation supporting the standard, and should provide rationale and justification for variation, when found necessary, from normal ASTM form and style. This should be developed under the guidance of a technical committee's editorial subcommittee, with executive subcommittee sanction.

C30.2 Copies of a variety of "white papers" may be requested from the Standards Department at Headquarters. Some committees who have white papers are: A-1 on Steel, Stainless Steel, and Related Alloys, B-8 on Metallic and Inorganic Coatings, C-11 on Gypsum and Related Building Materials and Systems, D-22 on Sampling and Analysis of Atmospheres, E-2 on Emission Spectroscopy, and E-3 on Chemical Analysis of Metals.

PART D
USE OF THE MODIFIED DECIMAL NUMBERING SYSTEM

INTRODUCTION

In recent years "point" systems for numbering sections of a document have come into extensive use. Many national organizations, associations, societies, industrial concerns, and government agencies are using a Modified Decimal Numbering (MDN) System. MDN is also used by international standardization organizations.

In 1963, ASTM adopted the MDN System for ASTM standards. This guide has been prepared for the use of members who are drafting or revising standards.

The object of the MDN System is to assign to each division in a text a unique number which will show the relationship of the specific section to all previous sections and will give a complete designation which will not require reference to previous sections or pages.

D1. Scope

D1.1 The Modified Decimal Numbering (MDN) System is designed primarily for numbering the text division in standards.

D1.2 The MDN System is also referred to as the "Point" System.

D2. Parts of a Standard

D2.1 All documents are considered to consist of several primary divisions called primary sections. A primary section may include one or more secondary sections. A secondary section may include one or more ternary sections which in turn may include one or more quaternary sections.

D2.2 The terms "primary section," "secondary section," "ternary section," and "quaternary section" shall not be used in headings or references.

D2.3 References shall be made by referring to *only* the number when referring to secondary, ternary, and quaternary sections. Refer to *primary* sections as "Section 4" or "Sections 5 to 9."

D2.4 Either of the generic words "section" or "division" may be used in correspondence or other communication, but shall not be used in references, other than primary, as directed in D2.2 and D2.3.

D3. Assignment of Numbers

D3.1 Number the primary sections of a standard serially, beginning with 1 or "Scope," using as many numbers as required by the number of sections.

D3.2 Assign to the successive secondary sections of any primary section a two-part number consisting of the number used for the primary section followed by a decimal point and a consecutive number, beginning with 1, using as many numbers as required by the number of secondary sections. For example, if there are eleven secondary sections in the fifth section of a standard, designate these secondary sections 5.1, 5.2, 5.3 . . . 5.9, 5.10, and 5.11.

D3.3 Assign to the successive ternary sections in a secondary section a three-part number consisting of the two-part number assigned to the secondary section followed by a decimal point and a consecutive number, beginning with 1, using as many numbers as required by the number of ternary sections. For example, if there are four ternary sections in secondary section 8.4, designate the ternary sections 8.4.1, 8.4.2, 8.4.3, and 8.4.4.

D3.4 Assign to each of the successive quaternary sections in a ternary section a four-part number consisting of the three-part number assigned to the ternary section followed by a decimal point and a consecutive number, beginning with 1, using as many numbers as required by the number of quaternary sections. For example, if there are three quaternary sections in the second ternary section of secondary section 8.4, designate them 8.4.2.1, 8.4.2.2, and 8.4.2.3.

D3.5 There shall be no further subdivision beyond that allowed by the four-part number. The judicious use of unnumbered center headings may help in the adherence to this rule.

D4. Supplementary Requirements

D4.1 Designate each supplementary requirement by the letter "S" followed by a consecutive number, beginning with 1 for the first supplementary requirement.

D4.1.1 There shall be no decimal point between the "S" and the number.

D4.2 Designate primary, secondary, and ternary sections of each supplementary requirement as shown in D3.2, D3.3, and D3.4, respectively.

NOTE D1—Primary sections of a supplementary requirement, an annex, or an appendix are numbered the same as a secondary section of the main standard (with two-part numbers); secondary and ternary sections of a supplementary requirement, an annex, or an appendix are, therefore, numbered the same as ternary and quaternary sections (with three and four-part numbers), respectively, of the standard.

D4.3 No individual supplementary requirement shall be subdivided into more than three levels in accordance with D3.5.

D5. Literature References

D5.1 Where a document includes five or more literature references, list them in a separate unnumbered section at the end of the document, preceding annexes and appendixes. Assign a one-part number to each individual reference. See Section G33 of this publication.

D6. Annexes and Appendixes

D6.1 Separate annexes and appendixes from the main text with the centered headings ANNEX(ES) and APPENDIX(ES).

D6.2 Precede the title of each annex by the letter "A" followed by a number in consecutive order, beginning with 1 for the first annex (A1, A2, A3, etc.). Precede the title of each appendix by the letter "X" followed by a number in consecutive order, beginning with 1 for the first appendix (X1, X2, X3, etc.).

D6.2.1 There shall be no decimal point between the "A" or "X" and the number.

D6.3 Designate primary, secondary, and ternary sections of each annex or appendix as shown in D3.2, D3.3, and D3.4 respectively (Note D1) (for example, A1.1, A1.1.1, and A1.1.1.1).

D6.4 No individual annex or appendix shall be subdivided into more than three levels in accordance with D3.5.

D7. Equations

D7.1 Assign consecutive arabic numbers to successive equations in the main text of the standard without regard to the section number in which it is referenced.

D7.2 Designate equations in annexes and appendixes by the designation of the annex or appendix followed by consecutive numbers beginning with 1 (for example, Eq A1.1, A2.4, X3.2).

D8. Tables

D8.1 Assign consecutive arabic numbers to successive tables throughout the main text of the standard without regard to the number assigned to the section in which the table is referenced.

D8.2 Designate tables in annexes and appendixes by the designation of the annex or appendix followed by consecutive numbers beginning with 1 (for example, Table A1.1, A2.4, X3.2). Tables shall follow directly the appropriate annex or appendix.

D9. Figures

D9.1 Assign consecutive arabic numbers to successive figures throughout the main text of the standard without regard to the number assigned to the section in which the figure is referenced.

D9.2 Designate figures in annexes and appendixes by the designation of the annex or appendix followed by consecutive numbers beginning with 1 (for example, Fig. A1.1, A2.4, X3.2). Figures shall follow directly any tables of the appropriate annex or appendix.

D10. Text Notes

D10.1 Assign consecutive numbers to successive notes throughout the main text of the standard without regard to the number assigned to the section to which the note may refer. Notes shall be indicated by the word "Note" followed by the number.

D10.2 Designate notes in annexes by the letter "A" and in appendixes by the letter "X," followed by consecutive numbers, beginning with 1.

D10.3 Designate notes pertaining to figures by consecutive numbers, beginning with 1 for the first note to each individual figure.

D11. Footnotes

D11.1 Assign consecutive numbers to successive footnotes throughout the standard, including supplementary requirements, annexes, and appendixes, without regard to the number assigned to the section in which the footnote appears.

NOTE D2—Since Footnote 1 is required for sponsoring committee and date of issue of a standard, the first footnote referenced in the body of the text is Footnote 2.

D11.2 Designate footnotes to tables by consecutive letters, beginning with the letter "A" for the first footnote to each individual table.

D11.3 Footnotes shall be referenced by superscript numbers, or, in the case of tables, by superscript italic capital letters.

D12. Combination of Systems

D12.1 Do not use a combination of the MDN System and other systems for designating secondary, ternary, and quaternary sections. For example, do not divide 8.4 into 8.4 (*a*), 8.4 (*b*), and 8.4 (*c*), rather than the 8.4.1, 8.4.2, and 8.4.3 as directed in D3.3.

D13. Omission of Numbers

D13.1 Do not assign MDN numbers to examples that are numbered serially throughout a document.

D13.2 Do not assign numbers to centered headings when used.

D14. Introductory Sections

D14.1 Where a standard has a preliminary section with a heading such as "Introduction" or "Foreword," do not assign this section a number so that "Scope" will always be designated with the one-part number "1" in accordance with D3.1.

D15. General Application

D15.1 Exercise care to distinguish between successive, parallel, and alternative sections and supplementary sections such as secondary, ternary, and quaternary sections. Only the latter three require the addition of another decimal point and number. Note also the manner of handling alternative clauses within a section. For example:

10. Procedure

10.1 Dry the specimen by either (*1*) heating at 105°C (221°F) for 2 h, or (*2*) holding the specimen in a conditioned atmosphere until dry to the touch.

Note that the above example is a single sentence and no further numbering breakdown is required.

10. Procedure

10.1 Make all tests on conditioned specimens using the procedure given in 10.3 and 10.4.

10.2 Calibrate the tension testing machine and see that the oven is at the specified temperature.

10.3 *Variable Frequency Procedure*

10.3.1 Adjust the . . .

10.3.2 Insert the . . .

10.4 *Variable Tension Procedure*

10.4.1 Start the . . .

10.4.2 Clamp the . . .

Note that in the above example, 10.3 and 10.4 are successive subdivisions of 10, not subdivisions of 10.1 or 10.2.

D16. Problems

D16.1 Any problems in the implementation of the MDN System in ASTM standards should be referred to the ASTM Managing Standards Editor for resolution.

PART E
PREPARATION AND USE OF TERMINOLOGY IN ASTM STANDARDS

E1. Introduction and ASTM Policy Concerning Clarity and Precision of Terminology

E1.1 Among the several kinds of ASTM standards that all ASTM technical committees should prepare, as appropriate to their missions, is ASTM standard terminology. Terminology is defined in the Regulations Governing ASTM Technical Committees as "a document comprising definitions of terms; descriptions of terms; explanations of symbols, abbreviations, or acronyms." Terminology is also included as appropriate in all other kinds of standards. The purpose of Part E is to provide for the guidance of technical committees (and of those who review or vote on the work of technical committees) the policies, rules, and recommendations governing the principles, form, and presentation of definitions and other kinds of terminology information. Terminology in its broad sense comprises the technical terms and nomenclature used in a field or discipline, together with their definitions, abbreviations, and symbols where appropriate.

E1.2 The ASTM Board of Directors has approved the following "Policy Concerning Clarity and Precision of Terminology":

> It is the policy of ASTM that its standards shall use terminology that is clear, explicit, and not liable to misinterpretation or misconstruction when referred to in technical operations, commercial contracts, or legal proceedings.
>
> To this end,
>
> (*a*) All significant terms used within a standard that may have a meaning more *specialized or more restricted than the common dictionary meaning* shall be defined either within the given standard or in a terminology standard referenced in the given standard.
>
> (*b*) All significant terms used within a standard that are unique to it, or have a meaning *more specialized or more restricted than other* technical meanings of the same term, shall be defined within the standard. If the applicable definition is restricted to that standard, it should be so categorized.
>
> (*c*) Qualitative adjectives and nouns that *could* be taken to denote or connote an *absolute, unqualified, or unconditional* property or capability shall not be used unless actually *used and defined* in their absolute sense. (Examples of such terms are: waterproof, stainless, unbreakable, vapor barrier, gas-free, flat, safe, rigid, pure, etc.)
>
> (*d*) Qualitative adjectives and nouns that denote or describe a *quantitative determinable* property or capability shall be used with caution, and shall be given a specialized quantitative definition (see Paragraph *b* above) wherever the lack thereof might lead to misinterpretation or confusion (Examples of such terms are: high, strong, transparent, accurate, clean, thin, hot, etc.)

E2. Guiding Principles Concerning ASTM Terminology

E2.1 *Objectives*:

E2.1.1 The objectives of ASTM terminology activities are:

E2.1.1.1 To ensure that ASTM standards will be properly understood and precisely interpreted.

E2.1.1.2 To promote standardization of terminology in standards, reports, and other technical writings.

E2.1.1.3 To explain the meanings of technical terms for the benefit of those not conversant with them. These objectives constitute the *basic criteria* as to whether an ASTM definition is needed in any particular case. Some specific guidelines follow in E2.3 through E2.4, but in case of doubt the foregoing objectives govern.

E2.1.2 For standard definitions to be effective, they should be used consistently at every opportunity. It shall, therefore, be the responsibility of each technical committee to ensure that usage in all standards over which it has jurisdiction is consistent with approved definitions (both its own and others).

E2.2 *"Definitions" and "Descriptions of Terms Specific to This Standard"*:

E2.2.1 An important distinction is to be made in ASTM standards between *standard definitions* and *descriptions of terms*.

E2.2.2 *ASTM standard definitions* are written to *promote all of the objectives* listed in E2.1.1, and apply beyond the standards in which they first originate. They are subject to review and coordination, and will be included in the *Compilation of ASTM Standard Definitions* (see E2.7). They shall be capable of standing on their own and clearly indicating or delimiting their field of applicability, as detailed in Section E5.

E2.2.3 *Descriptions of terms* are special-purpose definitions written to promote only the first of the objectives listed in E2.1.1, and *are not applicable beyond the standards containing them*. They are *not* subject to review and coordination, and will *not* be included in the *Compilation of ASTM Standard Definitions*. However, they should be consistent with and certainly not in conflict with ASTM standard definitions. For more specific guidelines see E3.4.

E2.3 *When ASTM Definitions Are Needed*:

E2.3.1 In general, an ASTM technical committee *should* write definitions (or descriptions of terms) for:

E2.3.1.1 All terms in its standards that are crucial to the interpretation and application of these standards and whose precise meaning may otherwise be subject to dispute.

E2.3.1.2 All important terms within its province that are not adequately defined in the common language or in existing ASTM definitions.

E2.3.2 In general, an ASTM definition should *not* be needed if:

E2.3.2.1 The term is a "general term," part of the common language, and an *adequate and clearly applicable* definition can be found in reputable abridged or "collegiate" dictionaries.

E2.3.2.2 The term is a broad technical term covering many fields and its meaning is well-understood and not subject to dispute (such as "force," "mass," "root-mean-square," "integral," etc.).

E2.3.2.3 The term is an *unambiguous combination* of other terms for which either ASTM or common-language definitions exist. However, such a term may still be worth including for completeness if it is one of a related group of terms.

E2.4 *Avoidance of Redundancies*:

E2.4.1 Maximum use should be made of existing definitions established by ASTM and other groups having related interests. Coordination should be effected among ASTM technical committees and between ASTM and other national and international groups.

E2.4.2 Before a technical subcommittee or task group writes a new definition, it should check whether a definition for the *same term and concept* (that is, with the same meaning) already exists in (*1*) the technical committee's terminology standard, (*2*) other standards under the jurisdiction of that committee, or (*3*) the *Compilation of ASTM Standard Definitions*. If so, a *new* definition should be written *only* if all existing ones are deemed incorrect or inadequate, and in such cases the justification for the new definition should be included as background information with letter ballots and with the submission to review groups (for example, Terminology or Editorial Subcommittees, and the Committee on Terminology).

E2.5 *Definitions Required Within an ASTM Standard*—Each ASTM standard shall contain definitions (or descriptions of terms) of all specialized key words in the title, and of all specialized terms in its text that are *crucial* to its understanding and application. If a definition is adopted from another source (including the committee's terminology standard), then that source should be referenced.

E2.6 *Terminology Standards for Each Technical Committee*:

E2.6.1 Each ASTM technical committee should maintain a terminology standard containing all definitions, abbreviations, symbols, etc., developed by that committee. If descriptions of terms are also included, they should be clearly distinguished from definitions, and each should have the applicable standard indicated.

E2.6.2 When any definition is revised, care must be taken to implement the revision both in the terminology standard and in any other standards containing that definition.

E2.7 *Compilation of ASTM Standard Definitions*—The Society publishes from time to time a *Compilation of ASTM Standard Definitions* serving as a comprehensive technical glossary for ASTM activities. The Committee on Terminology (see E2.8) is responsible for its content and format.

E2.8 *Coordination of Terminology*:

E2.8.1 The ASTM Board of Directors has established a Committee on Terminology (COT) to promote uniformity and minimize conflicts and redundancies in ASTM terminology through voluntary cooperation with the technical committees. Its specific tasks include promulgating guidelines, reviewing newly proposed standard definitions for adherence to proper form and to these guidelines, promoting coordination efforts among technical committees, and establishing policies for the *Compilation of ASTM Standard Definitions*. Each technical committee is urged to name one of its members as liaison representative to COT.

E2.8.2 Technical committees are requested to submit proposed new definitions to COT for review and comment concurrently with main committee or preferably with subcommittee ballot.

E2.8.3 Where several committees share a common field or discipline, they are encouraged to participate in Terminology Coordinating Groups sponsored by COT to develop coordinated terminology proposals.

E3. Integration of Terminology into a Test Method, Practice, or Specification

E3.1 *Applicable Headings*:

E3.1.1 The technical committee's terminology standard should be included under the "Applicable Documents" heading.

E3.1.2 A separate section of the standard should be headed "Terminology," which may contain the following subsections: "Definitions," "Descriptions of Terms Specific to This Standard," "Symbols," and "Abbreviations." (See also Sections A7 and B7.) If only one of these subsections is used, it is appropriate to use it as the heading.

E3.2 *Definitions*:

E3.2.1 Under this heading there should be only *ASTM standard definitions* (as defined in E2.2 and written in accordance with Section E4 to E8) and if desired, *discussion* (as described in E3.3).

E3.2.2 If an existing definition is adopted from another ASTM standard, it should be copied *precisely* in all its respects, and the originating standard should be identified in a parenthetic note following the definition, for example, (from G 40-77). This is to ensure that it will not be separately listed in the *Compilation of ASTM Standard Definitions*.

E3.3 *Discussion*:

E3.3.1 If a standard definition is applicable, but it is desired to add a tutorial discussion of that definition or of the concept represented, this may be done in a separate paragraph headed "Discussion," following the definition (including any "Notes" and cross-reference) proper. The discussion will *not* be included in the *Compilation of ASTM Standard Definitions*, and may be applicable only to the standard containing it.

E3.3.2 Material that could appropriately be included in a Discussion includes:

E3.3.2.1 Measurement units to be used in the particular standard if different from SI.

E3.3.2.2 Preferred methods of measurement, determination, construction, etc.

E3.3.2.3 Discussion of the defined concept in relation to other concepts.

E3.3.2.4 Significance or limitations of the concept in relation to the particular standard.

E3.3.3 Discussions should be restricted to helpful but not essential information. If the general definition *needs* to be amplified or qualified for the purposes of the standard, a suitably delimited definition or a description of term should be written. Avoid including any material under Discussion that properly belongs under test specifications or material specifications.

E3.4 *Descriptions of Terms Specific to This Standard*

E3.4.1 Under this heading there should be definitions and nomenclature that are *important to the standard but essentially restricted to that standard* (see E2.2). These may include:

E3.4.1.1 Terms coined or adopted in the standard for purposes of brevity or conciseness, but not used more widely in the industry or field.

E3.4.1.2 Terms that have other general technical or common meanings, but are given very specialized meanings for the purposes of the particular standard.

E3.4.1.3 Terms or definitions that have potential for wider applicability, but have not yet reached acceptance or consensus for wider use.

E3.4.1.4 Nomenclature applicable to parts of a specific test apparatus.

E3.4.2 Examples of types of definitions that should be classified as "Descriptions of Terms" are as follows:

engineer—the engineer in responsible charge of the work or his duly recognized or authorized representative.

failure—any continuous loss of pressure resulting from the transmission of test fluid through the body of the specimen under test.

OK value—the maximum weight, in pounds, added to the load lever weight pan, at which no scoring or seizure occurs.

rubber—a suitable type of natural, synthetic, or reclaim latex or any combination thereof, with added compounding ingredients of such nature and quality that will allow the finished product to comply with this specification.

seat—prepared position on the siege where the pot rests.

solar spectrum—for the purposes of these methods the solar spectrum at sea level extending from 350 to 2500 nm.

E3.4.3 It is recommended that the basic definition statements in "descriptions of terms" follow the guidelines for form given herein. However, the basic statement may be followed by expanded discussions.

E3.5 *Symbols and Abbreviations*—If a standard contains equations involving algebraic symbols, or frequently used abbreviations or acronyms, a subsection defining these is appropriate.

E4. The Anatomy of a Definition

E4.1 *Elements and Basic Form of the Definition*

E4.1.1 The *essential elements* of a definition entry are the term (which is a spoken or written representation of a mental concept), a *dash* (indicating equivalence), and a *basic one-sentence definition statement* for the concept to be associated with the term. The term is printed in boldface, for example:

pitch—the distance between corresponding points on adjacent crests.

E4.1.2 If the same term could have different meanings for other ASTM committees, then the definition should contain an italicized *delimiting phrase* or *field label*, following the dash and preceding the basic definition statement, for example:

pitch—*of a corrugated product*, the distance between corresponding points on adjacent crests.

(See E5.4 and E5.5 for more examples.)

E4.1.3 *Additional elements* may be required as listed below, in the sequence specified:

E4.1.3.1 After the term, but before the dash:

Part of speech (see E7.2.1)
Symbol (for a quantity) (see E6.1)
Dimensions (of a quantity) (see E6.3)
SI units (for a quantity) (see E6.4)

E4.1.3.2 After the basic definition statement:

Supplementary statements (see E4.5.1)
Cross-references to synonyms or related terms (see E8)
Notes (see E4.5.2)
Discussion (see E3.3)
Attribution, to be placed immediately after any material adopted verbatim from another source (see E3.2.2)

E4.1.4 The *basic definition statement* shall be complete in one sentence (or phrase) and shall be capable of standing alone as a technically correct definition.

E4.1.5 The definition shall be stated in the "*short form*" which does not repeat the complete term being defined. It should, however, be so stated that the substitution of a simple verb such as "is" or "means" in place of the dash (and removal of the delimiting phrase if any) would result in a grammmatically complete sentence.

E4.1.6 Do not begin definitions with phrases like "the term used for," since this usually contributes nothing more than that implied by the dash.

E4.2 *Structure of Definition Statement for Nouns*

E4.2.1 Generally, the basic definition statement should be of the *genus and differentia* type. The *genus* places the concept being defined within a broader class or group of concepts having common characteristics. The *differentia* identifies the additional individual characteristics that distinguish the concept being defined from all other concepts in the same genus, for example:

mathematics—the science of numbers and space.

The term "mathematics" represents a concept that belongs in the genus "science" and is distinguished from other sciences by the differentia "of numbers and space." This type of definition is also known as "classical definition," "Aristotelian definition," and "definition by intension."

E4.2.2 In some cases it may be simpler and clearer to employ a *definition by extension*, wherein the concept is defined by the enumeration of its parts or of the species for which it is the genus, for example:

sorption—a process consisting of absorption, adsorption, or chemisorption, or any combination of these.

E4.2.3 For physical or mathematical quantities, the most appropriate form may be an *operational definition*, which defines the concept by describing the operations required to measure or calculate it, even to the extent of including an algebraic equation, for example:

dissipation factor, *D*—the ratio of the loss index to its relative permittivity, or $D = \varepsilon''/\varepsilon'$.

E4.2.4 Even when the definition in substance is a definition by extension or an operational definition, it can be phrased formally as though it were a definition by genus and differentia. Thus, in the examples of E4.2.2 and E4.2.3, the formal role of genus is taken by "a process" and "the ratio" respectively.

E4.3 *Definitions of Verbs*:

E4.3.1 In conformance with common dictionary practice, verbs normally should be stated in the infinitive rather than the participle form, for example, "abrade" rather than "abrading." The term should be followed by "*v*" to indicate part of speech, and the definition should begin with the marker "to," for example:

sample, *v*—to obtain a portion representative of the material concerned.

Sometimes, however, the participle or gerund form may be preferable if commonly used and treated as a noun, for example, "fretting," "glass blowing."

E4.3.2 While no general rules can be given for the logical structure of a verb definition, the genus-and-differentia approach may still be applicable, for example:

weld, *v*—to join two pieces of material by heat or pressure or both until they are fused into one whole.

The genus is "to join two pieces of material"; the rest is the differentia.

E4.4 *Definitions of Adjectives*:

E4.4.1 Avoid attempting to define an adjective when the concept in mind is really a particular noun qualified by that adjective. In such cases the combination of adjective and noun should be defined, for example:

aplanatic lens—a lens corrected for spherical aberration and coma.
headless nail—a nail without upset or bend at head end.

E4.4.2 When an adjective is sufficiently general to warrant a definition by itself, then care must be taken that its definition statement is an adjectival phrase, for example:

acoustic, *adj*—pertaining to sound waves or sound fields.

E4.5 *Expansion of the Basic Definition*:

E4.5.1 *Supplementary statements* may be added immediately after the basic definition statement, to fill in more detail of the concept being defined. However, avoid developing this into an encyclopedic discussion.

E4.5.2 *Notes* may be appended to the definition; it is recommended that these be restricted to peripheral information such as usage, significance, relationships to other terms or other concepts, recommended units of measurement, etc.

E4.5.3 *Discussion* as described in E3.3 may be added. The main distinctions between notes and discussions are: Notes contain information of general applicability, are considered part of the definition to be reviewed by COT, and will be included in the "Compilation." Discussions may be specialized for a given standard and will not be reviewed or included in the "Compilation." The choice is up to the judgment of the definition originator.

E4.5.4 Do not define other terms used within a definition statement by means of inserted explanatory phrases. If any such terms need to be defined, separate definitions should be written for them.

E4.6 *Classified Grouping of Definitions*—In some cases it may be desirable to show the relationships in a logical family of concepts by appending narrower terms and their definitions (species) under the definition of the broader term (the genus) as the main entry. For example, the terms "flocculent structure," "honeycomb structure," and "single-grained structure" and their definitions are appended to the definition of "soil structure." In such cases the narrower terms shall also be listed alphabetically, with the cross-reference "—see . . ." to the broader term (see E8.2).

E5. Technical Content and Scope Indication

E5.1 *Basic Principles*:

E5.1.1 The definition should be technically accurate and should be written with due regard for other uses of the same term and for consistency with the definitions of broader, narrower, and related terms.

E5.1.2 The definition shall be written so that its meaning and application are clear when it is taken out of its original context (the originating standard) and placed alphabetically within the comprehensive *Compilation of ASTM Standard Definitions*.

E5.2 *Generalize Broad Concepts*—The definition shall be written in the broadest sense consistent with its meaning in the intended scope, and shall not be unnecessarily restricted to that scope by its wording. The example below violates this rule, since the meaning of "density" applicable here is quite general and need not be restricted to "fuel gas."

density—mass per unit volume of the fuel gas being considered.

E5.3 *Identify Narrow Contexts*—The definition of a specialized term shall be so written that its context or field of application is evident. The following example violates this principle, since its context remains a mystery to the uninitiated:

nub head—head with protruding knob.

It should have been written:

nub head—a nail head with a protruding knob.

E5.4 *Delimit Specialized Definitions of General Terms*—When a specialized definition is given for a term that also has other or more general technical meanings, its scope or field of application should be delimited by means of an *italicized introductory phrase* immediately following the dash and separated from the definition statement proper by a comma, for example:

head—*of a nail*, upset or deformation of the shank, opposite to point end, to be struck by hammer.
head—*of a hide*, that portion from the snout to the flare.
head—*in hydraulics*, a measure of the potential energy possessed by a liquid . . .

While this approach is preferred, any wording that clearly links the definition to the appropriate field of application is also acceptable, for example:

head—upset or deformation of the shank of a nail, . . . to be struck by hammer.

E5.5 *Specification Limits in Definitions*:

E5.5.1 If a definition involves specification limits (for example, in defining "plate" by specifying a thickness range) applicable only to a particular standard, it should be given under "Descriptions of Terms" rather than under "Definitions" (see E3.4).

E5.5.2 If, however, it is intended that such a definition be broadly accepted within ASTM or within a particular technical committee, then it can be written as an ASTM standard definition provided its scope is clearly delimited (see E5.4) and the specification limits have been established by the technical committees having jurisdiction. A hypothetical example would be:

plate—*for aluminum products*, a rolled flat product of thickness 0.250 in. or greater.

E6. Definitions of Physical and Mathematical Quantities

E6.1 *Letter Symbol*—For terms commonly represented by a letter symbol, indicate the preferred symbol after a comma immediately following the term. The choice of symbol should follow recommendations of appropriate standards or customary usage in the technical field. Letter symbols for *quantities* are printed in *italics*, those for *units* in upright letters.

E6.2 *Words and Equations*:

E6.2.1 The definition of a quantity should express its qualitative meaning or significance in words, and should also (if practicable) indicate how the quantity is measured or calculated, either in words or by an algebraic equation. This may be illustrated by "good" and "bad" examples for the same term as follows:

resistivity, ρ—that property of a material which determines its resistance to the flow of an electric current, expressed by

$$\rho = RA/L$$

where R = resistance of a specimen of cross-sectional area A and length L.

resistivity—the electrical resistance of a body of unit length and unit cross-sectional area.

E6.2.2 The first definition is far more complete and informative than the second. The second definition, while correct as far as it goes, does not indicate the concept's significance, nor that it is a material property, nor how it can be determined from a body that is *not* of unit length and cross section.

E6.3 *Analytical Dimensions*:

E6.3.1 If the term represents a physical quantity, its analytical "dimensions" should be stated in square brackets immediately following the letter symbol (or if there is none, following the term itself). Knowledge of the dimensions of a quantity assists in clarifying its concept, understanding its relationship to other quantities, assigning units, converting from one system of units to another, and in checking the consistency or completeness of equations containing it. Of course, dimensional analysis is widely used to identify the basic dimensionless parameters relevant to a physical phenomenon.

E6.3.2 Writers on dimensional methods agree that no one particular independent set of fundamental dimensions is the best for all circumstances. However, for consistency, it is recommended that dimensions be stated in terms of the set of fundamental dimensions corresponding to the base quantities in SI, using the dimension symbols given below:

[M]—mass
[L] —length
[T] —time
[I] —electric current
[Θ]—thermodynamic temperature
[N]—amount of substance
[J] —luminous intensity

If it is necessary to use any alternative fundamental dimensions, the symbols used must be defined in a note following the definition.

E6.3.3 Some mathematical quantities or variables are dimensionless, which means that they represent ratios of physical quantities and their numerical value is independent of the system of measurement units chosen. This may be indicated by the notation [dimensionless].

E6.4 *Measurement Units*:

E6.4.1 The concept associated with a quantity is generally quite independent of the measurement units chosen to evaluate it, and therefore the specification of units is not really a proper function of a definition. However, in order to help promote the use of and familiarization with SI units, applicable units consistent with ASTM E 380 (Standard for Metric Practice) may be listed in parentheses after the quantity symbol or dimensions.

E6.4.2 If preferred units other than SI units are to be specified at all, this should be done in a Note or in a Discussion appended to the definition within a particular standard (see E3.3).

E6.4.3 Exceptions to these general rules are those quantities expressed on a "scale" rather than by physical units, for instance, *sound power level* (expressed in decibels relative to specified reference). In such cases this information is a proper part of the definition.

E7. Grammatical and Editorial Considerations

E7.1 *Capitalization and Plurals:*

E7.1.1 Neither the term nor the definition statement shall be capitalized except for proper names or other words capitalized in normal usage.

E7.1.2 If a noun, the term should be stated in the singular unless the plural is the more usual form in normal usage.

E7.2 *Part of Speech:*

E7.2.1 If the term is other than a noun, or if there could be any doubt about the part of speech of the term, that shall be indicated by one of the following abbreviations, in italics, immediately following the term:

n—noun
v—verb
vt—verb, transitive
vi—verb, intransitive
adj—adjective
adv—adverb

E7.2.2 Care must be taken to ensure that the part of speech implied by the definition statement matches the part of speech of the term (see E4.4.2).

E7.3 *Permutation of Multiple-Word Terms:*

E7.3.1 The term may be a single word or a multiple word or phrase. If it is a multiple word in which one part is clearly subsidiary to the other and qualifies it, then the preferred entry is the permuted form with the root part first, for example, "induction, incremental" rather than "incremental induction." This serves to bring together related terms and narrower terms of a given genus. If, however, both parts are of comparable significance then it should be entered in the normal spoken form, for example, "shear stress" rather than "stress, shear."

E7.3.2 If either case, cross-reference from the other permuted form is required.

E8. Cross-Referencing

E8.1 *Uses of Cross-References*—A cross-reference can take the place of a definition, or can be appended to a definition to draw attention to related definitions. In the former case, the entry term is italicized and the term to which reference is made is printed in boldface; they are connected by the instructions "see," or "same as," or "discouraged term for," depending on the relationship between them. The guidelines below are intended to make cross-referencing consistent and informative.

E8.2 *Cross-References with Instruction "See"*—A cross-reference in the form "*X*—see *Y*" should be used *only* if the term with its definition is found in another location, specifically:

(a) If X is a permuted form of Y, use:

"*mechanical adhesion*—See **adhesion, mechanical**."

(b) If X is a species or part of Y, or otherwise related to Y, and its definition is appended to the definition of Y, use:

"*minor principal plane*—See **principal plane**."

E8.3 *Cross-References Between Synonyms*—When two or more terms are in use for the same concept—that is, they are synonymous—then the definition should be given with the preferred term or, lacking definite preference, the most commonly used one. The others should then be cross-referenced to that term in one of the following ways, assuming that the definition is given with term Y:

(a) If X is an accepted alternative term for Y, the entry for X should read:

X—same as **Y**.

(b) If the use of X is discouraged or "deprecated" in favor of Y, the entry for X should read:

X—discouraged term for **Y**.

(c) In either of the above cases, the definition given with Y may be followed by the parenthetic statement "(also *X*)."

E8.4 *Reference to Related Terms and Antonyms*—Cross-references to definitions of related, narrower or broader terms, or antonyms, can be appended to a definition. In many cases this can be very helpful in promoting the understanding of the concept being defined. Such cross-references should be in parenthetic statements or in notes, in the form: "See also X, Y, and Z" or "Compare X, Y, and Z."

PART F
LEGAL ASPECTS IN STANDARDS—SPECIAL INSTRUCTIONS

INTRODUCTION

This section contains special instructions for the use of commercial-contractual statements, caveats, patents, trademarks, specific sources of supply, references to other organizations, etc., in standards. When a standard contains any one of these statements or references, it is required that the committee obtain the necessary guidance from ASTM Headquarters for the inclusion in the standard.

F1. Commercial-Contractual Items in Standards

- Claims, settlement, and investigation statements
- Inspection statements
- Rejection and rehearing statements
- Costs of testing, retesting statements
- Open-end agreements (see B1.2)
- Purchasing
- Marking
- Certification

F1.1 The Society's legal counsel has offered the opinion that certain requirements such as now set forth in a number of sections covering adjustment of claims should not be included in the body of ASTM specifications. If a committee feels it is important that this type of information be given, the information preferably should be set forth in an appendix to the specifications.

F1.2 The matter of who shall pay for tests should be stated in the agreement or purchase order.

F1.3 General statements covering inspection, retests, and rejection are suitable text for specifications when they do not contain mandatory requirements covering the costs involved.

F2. Caveat Statements and Policies in Standards

F2.1 *Safety Hazards* Caveat—The Board of Directors adopted in January 1983 the ASTM Policy of Safety Precautions. Revisions to this policy were approved in (month/year).

F2.1.1 The generic caveat on *safety hazards* specified below shall appear in the Scope section of (*1*) test methods; (*2*) specifications where test methods are detailed other than by reference; and (*3*) practices and guides that involve the use of materials, operations, or equipment.

> This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

F2.1.1.1 When the standard does not involve the use of hazardous materials, operations or equipment, a request for an exception to the inclusion of the generic caveat shall be presented to the ASTM Standing Committee on Standards.

F2.1.2 Specific *warning* statements shall be included in the standard. When appropriate, precautionary statements may be included in the standard. (See Section A13 for the use of warning and precautionary statements.) These statements shall not prescribe specific remedial measures and actions. However, reference may be made to authoritative sources where reliable information concerning remedial measures can be obtained.

F2.1.3 Where there exists in a standard a specific warning or precautionary statement(s), reference to the appropriate section(s) shall be made following the generic safety hazards caveat in the scope.

F2.2 *Fire Hazard Caveat*—The Board of Directors adopted in September 1973 the ASTM Policy Defining Fire Hazard Standards, Limiting the Scope of Properties and Description Standards, and Establishing a Committee on Fire Hazard Standards (consolidated in 1977 to Committee E-5 on Fire Standards). Revisions to the ASTM Policy on Fire Standards were approved by the Board in January 1979. All ASTM standards that describe the response of materials, products, and assemblies to heat and flame shall contain the following caveat in italics in the scope:

> This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

In addition, the significance section must contain a full explanation of exactly what the standard is intended to cover, and any known limitations on its applicability. Standards that do not contain this caveat and explanation must either be reapproved by Committee E-5 on Fire Standards (for existing standards) or must be developed or endorsed within Committee E-5. The results of all tests shall be expressed in numerical terms. The use of adjectival or descriptive terms for classifying performance shall be avoided unless they are clearly stated to warn of some hazard connected with the anticipated or negligent use of environment (such as oxygen) of the material.

F2.3 *General Policy Caveat*—The Board of Directors approved the inclusion of a General Statement of ASTM Policy in all standards:

> This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing, you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

This statement will appear in a note at the end of the standard, following the note on ASTM Disclaimer of Liability as to Patented Inventions (see Section F3 on Patents in ASTM Standards).

F2.4 *Working Document Caveat*—The Board of Directors approved the use of the "Working Document" statement to be stated on the front page of every draft document or manuscript from a committee. The following suggested and proposed statement shall be typed or stamped on the document:

> This document is part of the ASTM standards process and is for ASTM committee use only. It shall not be reproduced or circulated or quoted, in whole or in part, outside of ASTM committee activities except with the approval of the chairman of the committee having jurisdiction or the President of the Society.

Anyone requesting an ASTM committee draft document (proposal standard, minutes, etc.) is entitled to receive a copy. However, after receipt of this document, they must adhere to the caveat.

F3. Patents in ASTM Standards

F3.1 When a technical committee desires to include in a standard of the Society any device, test procedure, material, or process involving the use of a patented invention, existing or pending, it shall request Headquarters for the proper forms and instructions. Standards including patents shall be handled in accordance with the latest revision of Section 15, Patent References in Standards, of the Regulations Governing ASTM Technical Committees.

F3.2 *ASTM Disclaimer of Liability as to Patented Inventions*—Neither ASTM nor an ASTM committee shall be responsible for identifying all patents under which a license is required in using an ASTM standard nor for conducting inquiries into the legal validity of such patents. Each ASTM standard, where applicable, shall include a note worded as follows:

> The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

F4. Use of Trademarks and Specific Sources of Supply for Apparatus, Reagents, and Reference Materials in ASTM Test Methods

F4.1 *Introduction:*

F4.1.1 To ensure the widest possible use of ASTM test methods it is imperative that sources of supply shall exist for apparatus, reagents, and reference materials. This is particularly important for unique, unusual, or difficult-to-obtain items.

F4.1.2 It is the responsibility of the sponsoring committee to assure itself that apparatus, reagents, and reference materials are available to the public so that a specific procedure can be performed. Each time an existing standard is reviewed or revised, and at the time a new standard is proposed, the committee shall make such a determination.

F4.1.3 The sponsoring committee shall provide to ASTM Headquarters the names and addresses of sources of supply and shall keep this information up to date. When specific trademarks are used or specific sources of supply are given, the following rules shall apply:

F4.2 *Apparatus, Reagents, and Reference Materials Necessary for Reproducible Results:*

F4.2.1 Reference to specific trademarks shall be permitted only when it has been found necessary to write part or all of the test method on the basis of a single commercial apparatus, reagent, or reference material in order to obtain sufficiently reproducible results (Note F1). References to specific commercial sources of supply shall be permitted only when one source, or a few sources, of supply are known and the source or sources are not likely to be generally known.

NOTE F1—Examples of such cases are found in Test Method D 531, for Rubber Property—Pusey and Jones Indentation (Vol 09.01) and in Test Method D 1824, for Apparent Viscosity of Plastisols and Organosols at Low Shear Rates by Brookfield Viscometer (Vol 08.02).

F4.2.2 Generally, the trademarks of apparatus, reagents, or reference materials should not appear in the title of methods. When the name of an apparatus is in the public domain such as "Rockwell" or "Saybolt Viscometer," such names may appear in the titles if approved by the Committee on Standards. Specific trademarks or apparatus, when necessary, may be included in the section on apparatus or in the scope, or in both, as determined by the technical committee in consultation with the technical and editorial staffs. Where it is possible to describe the apparatus in general terms and limiting parameters in the main text and to give the trademarks only in notes and footnotes, this should be done.

NOTE F2—Examples of such references are found in Test Methods D 1886, for Nickel in Water (Vol 11.01) and in Test Methods D 1888, for Particulate and Dissolved Matter in Water (Vol 11.01).

F4.2.3 Where details of a test method must be written on the basis of use of a specific apparatus, but the test method can be modified to permit the use of another apparatus, a note should be included after the description of the apparatus stating this.

NOTE F3—In the development of a standard test method, apparatus or instrumentation specific to the test method is frequently used. In many cases, the technical committee involved has managed to encourage the apparatus manufacturer to limit his production to exact replicas of the original. However, it has not always been possible to ensure exact reproduction of the apparatus or the instrument used by a committee for its original work, particularly when competing manufacturers enter the field or the original manufacturer terminates his business.

Due to these problems, plus the fact that an ASTM committee cannot become an apparatus certifying agency, the technical committee should include applicable calibration procedures in its standard test methods to permit the user of the test method to ensure that his test results will bear a direct relation to the test data developed elsewhere.

F4.2.4 The decision as to how references to specific apparatus, reagents, and reference materials or to sources of supply should appear in the standard will be left to the committee involved, in consultation with the technical and editorial staff.

F4.2.5 Information on sources of supply, when necessary, will be covered in footnotes.

F4.2.6 The decision as to whether alternative apparatus, reagents, or reference materials are equivalent shall be determined by the technical committee involved.

F4.2.7 When a mutually agreeable decision cannot be reached by the staff and the committee, the matter shall be referred to the Committee on Standards.

F4.3 In those cases where the apparatus cannot be purchased but must be built by each individual user, full information on the construction must be included in the ASTM document; if extensive information is necessary, suitable drawings and other details must be made available separately (see Section A26 on Adjuncts). Appropriate references should be included in the ASTM document to point out that the apparatus must be built and to describe the availability of detailed drawings, if these are necessary.

F5. Reference to Standards of Other Organizations

F5.1 When an ASTM standard makes reference to a standard of another organization, it is desirable to quote in the ASTM standard the pertinent parts of the other standard. If the standard from another organization is referenced in a number of ASTM standards in the same volume of the *Annual Book of ASTM Standards*, it may be desirable to include it in the Related Material section. In all cases, information on title, designation, year, and source and availability of the referenced standard shall be included. If substantial portions of the non-ASTM standard are quoted, or if such a standard is to be included in full or in part in the Related Material section, permission to republish must be obtained from the organization holding copyright.

F5.2 Joint logos shall not be used on ASTM standards, except with the authorization of the Board of Directors. When a standard has been developed in cooperation with another organization(s), a note may appear in the standard, however, referencing the credits of the other organization's participation.

F5.3 In cases of disagreement on implementation of the policy, the matter shall be referred to the Committee on Standards for decision.

PART G
STANDARDS STYLE MANUAL

G1. Manuscript Preparation

G1.1 Complete manuscripts, as proposed by standards writers, serve two purposes: (*1*) originally for voting purposes on subcommittee and main committee ballots, and (*2*) eventually for submittal to Headquarters for Society ballot and simultaneous editing for publication.

G1.2 To save time and errors in editing and as a service to the voter, complete new manuscripts should not be prepared for *revised* standards unless the revisions are sufficient in magnitude to require resetting the type (more than 25 %). When a completely new manuscript is submitted for a revised standard, it is advantageous for balloting purposes to mark in the margins for the voter, such as with a vertical line, those portions which have been revised (see sample manuscript). Do not underline the revised parts since to the printer this means italicize. Other formats, for submitting revisions constituting *less* than 25 % of the text, should be submitted in one of the following ways:

- photocopy of *latest* issue of standards with changes indicated in margins.
- list of those sections being revised with clear instructions stating the additions, substitutions, or deletions to be made.
- two-column comparison of current text on left-hand side with proposed revision on right-hand side of page.

G1.3 For the printed version of the standard the committee may include a brief description of the current revision to be included as part of Footnote 1 (see A24.2.1, B27.2.1). Some committees are now publishing rationale statements in an appendix to the standard.

G1.4 Type the manuscript on one side of 8½ by 11-in. (216 by 279-mm) white bond paper. Doublespace all manuscript; this means references, footnotes, figure captions, tables, abstracts, and the main text. Leave at least a 1-in. (25-mm) margin all around. Number all pages consecutively, beginning with the title page. The Society may return a single-spaced or poorly typed manuscript. If it is necessary to make some compromise to effect economies in balloting, manuscript may be typed on both sides of the paper, but double-spacing is mandatory.

G1.5 Submit the original copy of the manuscript to ASTM Headquarters for main committee ballot. This is the copy which will be used for final editing. Also send *with the manuscript* glossy prints of photographs and the original copy or tracings of line drawings (see G18). ASTM is not equipped to do the artwork or even correct it, so it is important that the illustrations be exactly as you wish them to appear. Use only *essential illustrations*. Provide good sharp prints of photographs on glossy paper. Mail photographs flat, not rolled, using sufficient firm cardboard to prevent creasing. Do not use clips, which may mar the print. Photomicrographs should be *unmounted*.

G1.6 Date or number all drafts to ensure that the Society receives the final copy. Also stamp the front page with the warning against unauthorized use (see F2.4).

G1.7 *Sample Manuscripts*—Reproduced on the following pages is a sample manuscript containing excerpts from an ASTM specification, with certain modifications. It is reproduced to illustrate the proper form and style for manuscripts. It is suggested that a copy of this sample be made available to the typist preparing the manuscript. Note the following aspects of the manuscript:

1. It is typed on 8½ by 11-in. (216 by 279-mm) paper with a 1-in. (25 mm) margin on all sides.
2. Double-spacing is used throughout.
3. Paragraph numbering and indentation are correct.
4. Underlining of revisions is not used. (An underline designates "italics" to the printer.) Instead, mark in the margins those portions being revised.
5. Metric equivalents are incorporated correctly in the text and tables.
6. Original manuscript is black enough for good photoreproduction.
7. The appropriate section headings from Part B of this publication are used correctly.
8. References to specifications are properly indicated in the text.
9. The Working Document caveat is included on the first page and the draft is numbered and dated.

This document is part of the
ASTM standards process and is for
ASTM committee use only. It shall
not be reproduced or circulated
or quoted, in whole or in part,
outside of ASTM committee
activities except with the
approval of the chairman of the
committee having jurisdiction or
the President of the Society.

Draft No. 4
Jan 26 1986

SAMPLE SPECIFICATION MANUSCRIPT

ASTM Designation: A_____

Standard Specification for

STEEL BARS, CARBON, HOT-ROLLED AND COLD-FINISHED, SPECIAL QUALITY, FOR PRESSURE PIPING COMPONENTS AND OTHER PRESSURE-CONTAINING PARTS

1. Scope

1.1 This specification covers hot-and cold-finished special-quality carbon steel bars subject to mechanical property requirements and intended for use in manufacturing components for pressure piping applications.

1.2 The bars are intended for machining, welding, hot forming, and threading by machining or cold rolling.

1.3 Pressure-containing parts other than piping components may be made from bars furnished to this specification.

1.4 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 ASTM Standards:

A 29 Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Rolled and Cold-Finished[2]

A 370 Methods and Definitions for Mechanical Testing of Steel Products[2]

3. Descriptions of Terms

3.1 Hot-Rolled Steel Bars -- Steel bars produced by hot rolling ingots, blooms, billets, or other semifinishdd forms to yield straight lengths (or coils, depending upon size, section, and mill equipment) in sections that are uniform throughout their length, and in the following sections and sizes:

3.1.1 Rounds, 7/32 to 10.0 in. (5.6 to 254 mm), inclusive,

3.1.2 Squares, 7/32 to 6.0 in. (5.6 to 152 mm), inclusive,

3.1.3 Round-Cornered Squares, 7/32 to 8.0 in. (5.6 to 203 mm), inclusive,

3.1.4 Flats, 1/4 to 8 in. (6.4 to 203 mm), inclusive, in width; 13/64 (0.2031) in. (5.159 mm) in minimum thickness up to 6 in. (152 mm) in width; and 0.230 in. (5.842 mm) in minimum thickness for over 6 to 8 in. (152 to 203 mm) in width, inclusive. Maximum thickness for all widths is 4 in. (102 mm), 3.1.5 Hexagons and Octagons, 1/4 to 4 1/16 in. (6.4 to 16.7 mm), inclusive, between parallel surfaces.

3.1.6 Bar-Size Shapes -- Angles, channels, tees, zees, when their greatest cross-sectional dimension is under 3 in. (76 mm), and

3.1.7 Special Bar Sections -- Half-rounds, ovals, half-ovals, other special bar size sections.

3.2 Cold-Finished Steel Bars -- Steel bars produced by cold finishing previously hot-rolled bars by means of cold drawing, cold rolling, turning, grinding, or polishing (singly or in combination) to yield straight lengths or coils in sections that are uniform throughout their length and in the following sections and sizes:

3.2.1 Rounds, 9 in. (229 mm) and under in diameter,

3.2.2 Squares, 4 in. (102 mm) and under between parallel surfaces,

3.2.3 Hexagons, 3 1/8 in (79.4 mm) and under between parallel surfaces,

3.2.4 Flats, 1/8 in. (3.2 mm) and over in thickness and not over 12 in. (305 mm) in width, and

3.2.5 Special Bar Sections.

3.3 Lot -- Unless otherwise specified in the contract or order, a lot shall consist of all bars submitted for inspection at the same time or the same heat, condition, finish, size, or shape. For bars specified in the quenched and tempered condition, when heat treated in batch-type furnaces, a lot shall consist of all bars from the same heat, of the same prior condition, the same size, and subjected to the same heat treatment in one tempering charge. For bars specified in the quenched and tempered condition, when heat treated without interruption in a continuous-type furnace, a lot shall consist of all bars from the same heat, of the same prior condition, of the same size, and subjected to the same heat treatment.

4. Classification

4.1 The bars are furnished in two grades as follows:

4.1.1 Grade B -- Tensile strength 60 000 psi (415 MPa), min; yield strength 35 000 psi (240 MPa), min.

4.1.2 Grade C -- Tensile strength 70 000 psi (485 MPa), min; yield strength 40 000 psi (275 MPa), min.

5. General Requirements for Delivery

5.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 29 unless otherwise provided herein.

6. Ordering Information

6.1 Orders for material under this specification shall include the following information:

6.1.1 Quantity (weight or number of bars),

6.1.2 Name of material (carbon steel bars),

6.1.3 Condition: hot rolled or cold finished (7.4.1),

6.1.4 Finish (if descaled required, so state) (10.1),

6.1.5 Dimensions (diameter, thickness, width, and length),

6.1.6 Cross section (round, square, hexagon),

6.1.7 ASTM designation and year of issue,

6.1.8 Grade (Tables 1 and 2),

6.1.9 End use, and

6.1.10 Additions to the specification and supplementary requirements, if required.

Note -- A typical ordering description is as follows: 10 000 lb, Carbon Steel Bars, Hot-Rolled, Descaled, 1.000-in. diameter by 10 ft, Round, ASTM A____dated______, Grade B; Supplementary Requirement S1 Straightness 0.125 in. in any 5 ft.

7. Manufacture

7.1 Melting Practice -- The steel shall be made by the open-hearth, basic-oxygen, or electric-furnace process.

7.2 Deoxidation -- The steel shall be fully killed.

7.3 Quality -- The bars shall be special quality.

7.4 Hot or Cold Working:

7.4.1 The bars shall be hot rolled or cold finished as specified by the purchaser.

7.4.2 Cold-finished bars reduced in cross-sectional area more than 10 % by cold drawing or rolling shall be heat treated as specified in 7.5.2.

7.5 Heat Treatment:

7.5.1 Except as provided in 7.5.2, the bars shall be furnished as-hot rolled or as-cold finished.

7.5.2 Cold-finished bars cold worked in excess of 10 % (see 7.4.2) shall be stress-relief annealed at not less than 1200°F (650°C), normalized, or fully annealed. The specific heat treatment shall be at the option of the producer or supplier.

8. Chemical Composition

8.1 Heat Analysis -- The heat analysis shall conform to the requirements as to chemical composition prescribed in Table 1.

8.2 Product Analysis -- A product analysis of the steel may be made by the purchaser and shall conform to the requirements of Table 1 subject to the product analysis tolerances specified in Specification A 29.

9. Tensile Properties

9.1 The material, as represented by the test specimens, shall conform to the tensile properties prescribed in Table 2.

9.2 A deduction from the percentage of elongation specified in Table 2 of 1.0 % shall be made for each 1.0 in. (25.4 mm) of specified diameter over 2.0 in. (51 mm) or fraction thereof to a maximum of 3 %.

10. Finish and Appearance

10.1 Descaling -- When descaled bars are required, Supplementary Requirement S7 must be specified.

11. Workmanship and Quality Level Requirements

11.1 The bars shall be free of visible pipe and conditioned as necessary to remove injurious surface imperfections.

12. Sampling

12.1 A lot shall consist of all bars of one size from one heat, processed at one time, and subjected to the same heat treatment when heat treated.

13. Number of Tests

13.1 One tension test shall be made from each lot.

14. Specimen Preparation

14.1 Tension test specimens shall be taken longitudinally from a position midway between the center and the surface of the bar or as close as practical to this location for small sizes.

14.2 When it is impractical to remove specimens in accordance with 14.1, they shall be taken in accordance with Methods A 370.

15. Test Methods

15.1 Tension tests shall be made in accordance with Methods A 370. The yield strength shall be determined by the 0.2 % offset or 0.5 % extension under load methods.

16. Inspection

16.1 Inspection of the material shall be agreed upon between the purchaser and the producer or supplier as part of the purchase contract.

17. Rejection and Rehearing

17.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the tests, the producer or supplier may make claim for a rehearing.

18. Certification

18.1 When specified in the purchase order or contract, a manufacturer's or supplier's certification shall be furnished to the purchaser stating that samples representing each lot have been manufactured, tested, and inspected in accordance with this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

19. Product Marking

19.1 Bars 2.0 in. (51 mm) and larger in diameter or thickness shall have the heat number stamped on one end.

20. Packaging and Package Marking

20.1 Bars less than 2.0 in. (51 mm) in diameter or thickness shall be tightly banded with a sufficient number of bands of adequate strength to minimize bundle breakage during handling and shipping. Each bundle shall bear a weather-resistant tag showing the purchase order number, ASTM designation number and grade, heat number, size, and name of manufacturer.

20.2 Larger sizes shall be packaged and marked in accordance with Specification A 29.

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the contract or order.

S1. Special Straightness

S1.1 Bars shall be within the tolerances for special straightness.

S2. Stress Relief Anneal

S2.1 Bars shall be stress-relief annealed (may be specified for bars that have been ordered to special straightness tolerance).

S3. Surface Quality

S3.1 Bars shall be produced to special surface quality requirements which shall be negotiated between purchaser and producer or supplier.

S4. Special Internal Soundness

S4.1 Bars shall be produced with special internal soundness to be verified by one or more macroetch samples. Acceptance limits shall be negotiated between purchaser and producer or supplier.

S5. Fine Grain Practice

S5.1 The grain size shall be 5 to 8, inclusive. The grain structure shall be considered satisfactory if 70 % is within the specified limit.

S6. Restricted Size Tolerances for Hot-Rolled Bars

S6.1 Bars shall be furnished with tolerances on dimensions more restrictive than specified in Specification A 29. Tolerance requirements to apply shall be negotiated between purchaser and producer or supplier.

S7. Descaling

S7.1 Bars shall be furnished descaled and oiled.

TABLE 1 Chemical Composition (Heat Analysis), %

	Grades B and C
Carbon, max	0.32
Manganese, max	1.04
Phosphorus, max	0.035^A
Sulfur, max	0.045^A
Silicon	0.15 to 0.30
Lead	A

^{A}Phosphorus, sulfur, or lead, or a combination thereof, shall not be added.

TABLE 2 Tensile Properties

	Grade B	Grade C
Tensile strength, min, ksi (MPa)	60 (415)	70 (485)
Yield strength, min, ksi (MPa)	35 (240)	40 (275)
Elongation in 2.0 in. or 50 mm, min, %	20.0	18.0
Elongation in 8.0 in. or 200 mm, min, %^{A}	17.0	15.0

^{A}Applicable to bars 1 1/2 in. (38 mm) in diameter tested full size.

G2. Styling

G2.1 Check the manuscript against the rules given in this style manual. Many technical committees have formed editorial subcommittees who give the manuscript a final review before submittal to Headquarters. Final styling is done by the ASTM editorial staff, but your cooperation will ensure speedier publication at less expense to the Society. A number of forms of assistance available to the ASTM standards-writer are listed in the Introduction to this manual.

G2.2 Of the instructions that follow, some are included because they are deviations from the standard references, some because they are used frequently and are therefore listed here for convenience. Sections on various points of ASTM style appear in the following alphabetical order:

	Section
Abbreviations and Unit Symbols	G3
Alloy Designations	G4
And/or	G5
Capitalization	G6

	Section
Chemical Formulas	G7
Compression Test	G8
Contractual Parties	G9
Crystal Planes and Directions	G10
Dictionaries	G11
Dilution Ratio	G12
Flexure Test	G13
Footnotes	G14
Foreign Terms	G15
Greek Alphabet	G16
Hyphens	G17
Illustrations (Figures) and Captions	G18
Isotopes	G19
Italics	G20
Mathematical Material	G21
Metric Conversion	G22
Multiples and Submultiples	G23
Notes	G24
Numbering	G25
Numerals	G26
Percent versus Percentage Points	G27
Photomicrographs	G28
Polymers	G29
Powers of 10	G30
Proofreader's Marks	G31
Quotations	G32
References	G33
Sample versus Specimen	G34
Spelling	G35
Standards, Reference to	G36
Symbols	G37
Tables	G38
Tension Test	G39
Thermal Conductivity	G40
Thermometers	G41
Trademarks	G42

G3. Abbreviations and Unit Symbols

G3.1 In the text, use unit symbols after numbers denoting a definite quantity. Example: "The tensile strength is 45 000 psi (310 MPa)."

G3.2 Use unit symbols in tables and figures, and in lists defining symbols used in equations.

G3.3 Use unit symbols and abbreviations in the singular only. Thus "fifty kilograms" shall be designated "50 kg," not "50 kgs." Exceptions: Figs., Nos., Eqs, Refs, Vols.

G3.4 When a long word or phrase for which there is no standard abbreviation is used frequently, it may be replaced by an abbreviation that is explained when it first occurs. Examples: below top dead center (btdc), relative centrifugal force (rcf).

G3.5 Commonly accepted abbreviations for names of societies, associations, government agencies, etc., may be used, provided the name is spelled out the first time it is used. Use no periods and run together. Examples: ASTM, ASME, TAPPI, NASA, ARPA.

G3.6 The standard unit symbols and abbreviations for use in Society publications in the list below are so common that they may be used without explanation. Many of these have been selected from the American National Standard Abbreviations for Use on Drawings and in Text (ANSI Y1.1) and Letter Symbols for Units Used in Science and Technology (ANSI Y10.19). Official SI unit symbols are also included. For proper form and style for SI units see ASTM E 380.

absolute	abs
academic degrees	use periods and run together (M.S., Ph.D., etc.)
alternating current, *n.*	ac
alternating current, *adj.*	a-c
American	Am.[A]
American wire gage	AWG
ampere	A
ampere hour	Ah
angstrom	Å
ante meridiem	a.m.
Association	Assn.[B]
atmosphere	atm
average	avg
barrel	bbl
becquerel	Bq
billion electronvolts	(use GeV, gigaelectronvolts)
Birmingham wire gage	BWG
brake horsepower	bhp
brake-horsepower hour	bhp·h
Brinell hardness number	HB (see ASTM E 10)
British thermal unit	Btu
Brown and Sharpe (gage)	B&S
bushel	bu
calorie	cal
candela	cd
centimetre	cm
centipoise	cP
centistokes	cSt
circular mil	cmil
coefficient	*spell out*
Company	Co.[B]
Corporation	Corp.[B]
coulomb	C
cubic	use exponential form[C]
cubic centimetre	cm^3
cubic decimetre	dm^3
curie	Ci
cycles per minute	cpm
cycles per second	(use Hz, hertz)
day	*spell out*
decibel	dB
degree (angle)	°
degree Celsius	°C
degree Fahrenheit	°F
degree Rankine	°R
degrees of freedom	df
Department	Dept.[B]
diameter	dia (in figures and tables only)
differential	d
direct current, *n.*	dc
direct current, *adj.*	d-c
Division	Div.[B]
dollar	$
effective horsepower	ehp
electromotive force	emf
electronvolt	eV
Engineers	Engrs.[A]
equation(s)	Eq(s)
farad	F
figure(s)	Fig(s).[D]
foot	ft

[A] In footnotes and references only.

[B] At end of name only.

[C] With unit symbols only.

[D] Only when followed by a number.

footcandle	fc
foot pound-force	ft·lbf (use for work, energy) (see lbf·ft)
gallon	gal
gauss	G
gilbert	Gb
grain	*spell out*
gram	g
gravity (acceleration)	*g*
gray	Gy
half hard	½ H
henry	H
hertz	Hz
horsepower	hp
horsepower hour	hp·h
hour	h
Hurter and Driffield scale (film density)	H&D
hydrogen ion concentration, negative logarithm of	pH
inch	in
inch of mercury	in. Hg
inch of water	in. H_2O
inch pound-force	in·lbf (use for work, energy) (see lbf·in.)
inclusive	incl (in figures and tables only)
Incorporated	Inc.[B]
indicated horsepower	ihp
inside diameter	ID (in figures and tables only)
Institute	Inst.[B]
integrated neutron flux	nvt, n/cm^2
iron pipe size	IPS
joule	J
K alpha radiation	K_α
kelvin	K
kilocalorie	kcal
kilocycle per second	(see note on cycles per second)
kilogram	kg
kilogram-calorie	kg cal
kilogram-force	kgf
kilogram metre	kg·m
kilometre	km
kilovolt	kV
kilovolt ampere	kVA
kiloelectronvolt	keV
kilovolt peak	kVp
kilowatt	kW
kilowatt hour	kWh
kip (1000 lbf)	*spell out*
kip (1000 lbf) per square inch	ksi
Knoop hardness number	HK (see ASTM E 384)
lambert	L
linear	*spell out*
litre	L
logarithm (common)	log
logarithm (natural)	ln
lumen	lm
lux	lx
magnetomotive force	mmf
mass-to-charge ratio	*m/e*
maximum	max (in figures and tables only)
maxwell	Mx
median effective concentration	EC_{50}
median effective dose	ED_{50}
median lethal concentration	LC_{50}
median lethal dose	LD_{50}
megacycles per second	(see note on cycles per second)
megawatt	MW
meta	*m*
metre	m
microampere	μA
microcurie	μCi
microfarad	μF
microgram	μg
microhenry	μH
microinch	μin
microlitre	μL
micro-micro (prefix, use pico)	p
micrometre (formerly micron)	μm
microroentgen	μR
microsecond	μs
microvolt	μV
microwatt	μW
mil	*spell out*
mile	*spell out*
miles per hour	mph
milliampere	mA
milli-angstrom	mÅ
millicurie	mCi
milliequivalent	meq
milligram	mg
millihenry	mH
millilitre	mL
millimetre	mm
millimetre of mercury	mm Hg
million electronvolts	MeV
milliroentgen	mR
millisecond	ms
millivolt	mV
milliwatt	mW
minimum	min (in figures and tables only)
minute	min (spell out when used with minimum)
molal	*spell out*
molar	*M*
mole	mol
month (When followed by a date use Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec. When there is no date, spell out. Examples: Jan. 15, 1983; January 1983)	*spell out*
nanometre (formerly millimicron)	nm
National	Nat.[B]
newton	N
normal	N
number(s) (This abbreviation can often be omitted entirely. It is usually understood (as in *STP* 625, Specimen 8, Test 14, etc.)	No(s).[B]
oersted	Oe
ohm	Ω
ortho	*o*
ounce	oz
outside diameter	OD (in figures and tables only)
page	p
pages	pp
para	*p*
parts per billion	ppb
parts per million	ppm
pascal	Pa
per	use the diagonal line in expressions with unit symbols[F]
percent	%
pico (prefix)	p
picofarad	pF
pint	pt
poise	P

[F] Exceptions: cpm, mph, psi

Poisson's ratio	μ (ν is preferred in applied mechanics)
post meridiem	p.m.
pound	lb
pound-force	lbf
pound-force foot	lbf·ft (use for torque) (see ft·lbf)
pound-force inch	lbf·in. (use for torque) (see in·lbf)
pound-force per square foot	lbf/ft^2
pound-force per square inch	psi or lbf/in.^{2}
pound-force per square inch absolute	psia
pound-force per square inch gage	psig
quart	qt
rad (dose unit)	rd
radian	rad
radio frequency, *n*	rf
radio frequency, *adj*	r-f
radius	R (in figures and tables only)
Railway	Ry.[B]
Railroad	R.R.[B]
reference(s)	Ref(s)
relative humidity	RH (in figures and tables only)
revolution per minute	r/min
revolution per second	r/s
Rockwell hardness, C scale	HRC (see ASTM E 18)
roentgen	R
root mean square	rms
Saybolt Furol seconds	SFS
Saybolt Universal seconds	SUS
second	s
secondary	sec
siemens	S
Society	Soc.[B]
socket joint (tables and drawings only)	§
specific gravity	sp gr
square	use exponential form (exception: psi, ksi)[C]
standard taper (tables and drawings only)	$
steradian	sr
stokes	St
tensile strength	*spell out*
tertiary	*tert*
tesla	T
thousand electronvolts	keV
thousand pounds	kip
thousand pounds-force per square inch	ksi
ton	*spell out*
torr	*spell out*
United States, *n*	*spell out*
United States, *adj*	U.S.
United States Pharmacopeia	USP
versus	*spell out*
Vickers hardness number	HV (see ASTM E 92)
volt	V
volume (of a publication)	Vol[B]
watt	W
watt hour	Wh
weber	Wb
week	*spell out*
yard	yd
year	*spell out*
Young's modulus	*E*

Abbreviations of States and Provinces:

	States
Alabama	AL
Alaska	AK
Arizona	AZ
Arkansas	AR
California	CA
Colorado	CO
Connecticut	CT
Delaware	DE
Florida	FL
Georgia	GA
Hawaii	HI
Idaho	ID
Illinois	IL
Indiana	IN
Iowa	IA
Kansas	KS
Kentucky	KY
Louisiana	LA
Maine	ME
Maryland	MD
Massachusetts	MA
Michigan	MI
Minnesota	MN
Mississippi	MS
Missouri	MO
Montana	MT
Nebraska	NE
Nevada	NV
New Hampshire	NH
New Jersey	NJ
New Mexico	NM
New York	NY
North Carolina	NC
North Dakota	ND
Ohio	OH
Oklahoma	OK
Oregon	OR
Pennsylvania	PA
Rhode Island	RI
South Carolina	SC
South Dakota	SD
Tennessee	TN
Texas	TX
Utah	UT
Vermont	VT
Virginia	VA
Washington	WA
West Virginia	WV
Wisconsin	WI
Wyoming	WY
District of Columbia	DC

	Canadian Provinces
Alberta	Alta.
British Columbia	B. C.
Manitoba	Man.
New Brunswick	N. B.
Newfoundland	Nfld.
Nova Scotia	N. S.
Northwest Territories	N. W. T.
Ontario	Ont.
Prince Edward Island	P. E. I.
Province of Quebec	P. Q.
Saskatchewan	Sask.
Yukon Territory	Y. T.

G4. Alloy Designations

G4.1 Use the following for alloy designations:

3135 steel

2024-T4 aluminum
Ti-4A1-3V-Mo
Ti-6A1-4V
0.5Ti molybdenum alloy or
molybdenum with 0.5 % titanium or
0.5Ti alloy (where molybdenum is understood)

G4.2 ASTM and SAE have jointly developed a new unified numbering system (UNS) for alloy identification (E 527). This new system is gradually replacing previous alloy designations.

G5. And/Or

G5.1 Do not use this expression. If "*A* and/or *B*" is truly the case, write "*A* or *B*, or both." For "A, B and/or C" write "A, B, or C, or combination thereof."

G6. Capitalization

G6.1 Use capitals sparingly.

G6.2 In headings and titles, capitalize all nouns, pronouns, verbs, adjectives, adverbs, and all other words of five or more letters. Do not use initial caps on abbreviations (except see G6.6), on the phrase "et al." or in the word "to" in the infinitive form of a verb.

G6.3 Use initial cap for "committee" where used in a title, as "Committee A-1," "Committee on Publications." Everywhere else use lower case, as "The committee recommends." This rule also applies to use of "symposium," etc.

G6.4 Use initial cap on Society, Staff, and Headquarters when referring to ASTM, its Staff, and its Headquarters.

G6.5 Capitalize trademarks. The initial cap becomes lower case after the word is accepted into the language as generic. When in doubt, capitalize. The following are now lower case: babbitt, bunsen, cellophane, diesel, kraft, neoprene, nylon, portland cement, saran.

G6.6 Use initial cap in referring to volumes, figures, tables, etc., as Vol 2, Fig. 2, Table 2. Use lower case in less direct references such as : "This volume contains . . . ." "In the same figure is shown . . . ."

G6.7 Use initial caps in such expressions as: Test 1, Specimen A, Cement B, Type 1, Class C, Grade B, etc.

G6.8 It is permissible to use all caps in directions such as "Turn the machine to OFF position" or "Turn the dial to TITRATE."

G7. Chemical Formulas

G7.1 Chemical formulas should be used freely in tables and figures. In text in which chemical formulas are mentioned infrequently, spell out the names. Where they are mentioned frequently, spell out the name in the first reference to it, followed by the formula in parentheses. The formula alone may be used subsequently. Do not use chemical formulas for organic or complex inorganic compounds. Always spell out the word "water" and the names of the elements (use lead, not Pb). Isotopes may be written as carbon-14 or as ^{14}C.

G8. Compression Test

G8.1 See Section G39, Tension Test.

G9. Contractual Parties

G9.1 Terms describing contractual parties shall be limited to the following:

Party of the first part—producer, supplier, seller, or manufacturer.

Party of the second part—purchaser or user.

G10. Crystal Planes and Directions

G10.1 Use the following symbols for crystallographic planes and directions:

plane (111)
family of planes {111}
direction [111]
family of directions $\langle 111 \rangle$

G11. Dictionaries and Other Reference Publications on Style

G11.1 For spelling, punctuation, capitalization, foreign words, use *Webster's Ninth New Collegiate Dictionary*. For words that do not appear in that dictionary, use *Webster's Third New International Dictionary*. For chemical nomenclature, use the section on nomenclature in *Directions for Abstractors and Section Editors of Chemical Abstracts*. For other information on style use *A Manual on Style*, The University of Chicago Press.

G12. Dilution Ratio

G12.1 Use the form "9 + 1" rather than "9:1" for dilution ratios.

G13. Flexure Test

G13.1 See Section G39, Tension Test.

G14. Footnotes

G14.1 For footnotes in tables, use superior italic capital letters, beginning anew for each table. Type the footnotes below the table.

G14.2 For all other footnotes, use superior numbers. Type all footnotes referenced in the text on a separate sheet.

G14.3 Do not use footnotes in figure captions. Either cite a previous footnote or reference (for example, "see Footnote 3," or "taken from Ref **(4)**"), or write out the reference in the caption. For style of publication footnotes, see Section G33, References. See also Section G36, Reference to Standards.

G15. Foreign Terms

G15.1 Use italics for foreign words and phrases. Consult the dictionary to see whether a word is foreign or English. In *Webster's Ninth New Collegiate Dictionary*, foreign words are marked by two vertical bars preceding the entry.

G16. Greek Alphabet

G16.1 For convenience the Greek alphabet is given in the accompanying table.

Alpha	A	α	Nu	N	ν
Beta	B	β	Xi	Ξ	ξ
Gamma	Γ	γ	Omicron	O	o
Delta	Δ	δ	Pi	Π	π
Epsilon	E	ϵ	Rho	P	ρ
Zeta	Z	ζ	Sigma	Σ	σ
Eta	H	η	Tau	T	τ
Theta	Θ	θ	Upsilon	Υ	υ
Iota	I	ι	Phi	Φ	ϕ
Kappa	K	κ	Chi	X	χ
Lambda	Λ	λ	Psi	Ψ	ψ
Mu	M	μ	Omega	Ω	ω

G17. Hyphens

G17.1 The hyphen seems to be the most troublesome punctuation mark. In ASTM standards hyphenate compound adjectives, such as: "50-mm gage," "low-alloy steel," "cold-drawn wire." Write expressions such as the following *with* the hyphen after the first word: "high- and low-temperature tests." Where numerals are involved, omit all but the last hyphen, as in "50, 100, and 150-mm specimens." For the sake of appearance, omit hyphens in such expressions as "3 % nickel alloy" or "3°C rise in temperature." Also, do not hyphenate chemical compounds, and the words "stainless steel" and "cast iron."

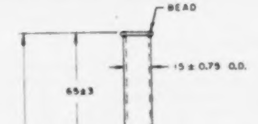
G17.2 Do not hyphenate an adverb-adjective combination in which the adverb ends with "*ly*," such as "newly puddled iron."

G17.3 Spelled-out fractions used as nouns are *not* hyphenated (one third of the load); used as adjectives, they *are* hyphenated (a one-third share).

G18. Illustrations (Figures) and Captions

G18.1 Illustrations shall be designated as figures with arabic numbers. Line drawings are preferable to photographs. Furnish short titles or captions for each illustration. See also G1.4.

G18.2 In preparing the drawings, due consideration should be given to the arrangement of the figure and the character and width of lines for reduction in reproduction. Original tracings or drawings should be submitted twice the size that they should appear in the standard, as it is economically desirable to reduce all drawings to one-half size in reproduction. The lettering should be of adequate size so that it will be legible after the one-half reduction. Use black India ink with a lettering set or press-on lettering. Typed lettering does not reproduce well; free-hand lettering gives a nonprofessional appearance. For figures or illustrations that will fit across a single column of type (2½ in., 63.5 mm) the drawing should be 5 in. (127 mm) wide, maximum, and those to appear across the full page (5¼ in., 133 mm) should be 10½ in. (266 mm) wide, maximum. When the height of the drawing is the governing dimension, it should preferably be not more than twice the height of the typed page (7¼ in., 184 mm), or 14½ in. (368 mm). When extra space is required for the figure caption, allow for this by reducing the height of the drawing. The maximum drawing size should, therefore, be kept within 10½ by 14½ in. The accompanying specimen drawing (original was 4¾ by 7 in., 121 by 178 mm) may be used as a guide. For additional information on preparation of drawings for publication, see American National Standard Y15.1, Illustrations for Publications and Projection.



All dimensions are in millimetres.

FIG. G1 Gravimetric Receiver

G18.3 Where a graph with one or more curves is considered essential, the instructions given in G18.1 and G18.2 apply. In plotting curves it may be possible to make the drawing so that it can be used directly, with some retouching, thus obviating the necessity of having new drawings made for reproduction, which involves delay and additional expense. In load-elongation curves, the elongation shall be the abscissa and the load the ordinate.

G18.4 When it is necessary to use photomicrographs, refer to ASTM Practice E 883 for Metallographic Photomicrography (Vol 03.03). The following information may be obtained from this reference: standard magnifications; the use of rectangular rather than circular micrographs; and explanatory title giving magnification, etching medium (if one was used), treatment, etc.

G18.5 It is the committee's responsibility to provide glossy prints or line drawings of professional quality ready for the printer's camera at the time of submittal of the manuscript. The Society cannot provide drafting services.

G18.6 When illustrations are subdivided ((*a*), (*b*), (*c*), etc.), use the following arrangement:

G18.6.1 In line drawings, put the subdivision letter and the distinguishing description directly on the illustration. For example, the figure caption might read "FIG. 1 *S-N* Curves." Lettered directly on the three parts of the illustration would be the descriptions: "(*a*) Aluminum alloys," "(*b*) Steels," and "(*c*) Magnesium alloys."

G18.6.2 In photographs, one of the three methods may be used:

G18.6.2.1 Ink the subdivision letter directly on the photographs and letter the subcaptions: "(*a*) Aluminum alloys, (*b*) Steels, (*c*) Magnesium alloys."

G18.6.2.2 If there is no need in the text to refer to "Fig. 1(*a*)" or "Fig. 1(*b*)," there is no need to use subdivision letters on the illustration. The subcaption may then read: "(*left*) aluminum alloys, (*center*) steels, (*right*) magnesium alloys (or (*top*), (*center*), and (*bottom*)).

G18.6.2.3 The three parts of the subcaption may be inserted directly under the three parts of the illustration. If the illustrations are arranged vertically, it will be necessary to cut apart the engraving to do this.

G18.7 In photomicrographs and other illustrations where a magnification is significant, give the magnification in parentheses at the end of the caption, for example, (×10 000). If the illustration is reduced for publication, state the reduction. Example: "Fatigue crack at root of notch (×5000, reduced one half for reproduction)."

G18.8 All copy subordinate to the main caption should appear *above* the main caption.

G19. Isotopes

G19.1 Isotopes of elements may be designated as, for example, carbon-14 or ^{14}C.

G20. Italics

G20.1 Use italics for the following:

G20.1.1 All symbols for physical quantities that can have a numerical value (quantity symbols).

G20.1.2 Letters and numbers used as legends for identification of parts in illustrations, such as, Section *A-A*, Tube *C*, Dial *3*, etc. (Where practical, use letters rather than numbers.)

G20.1.3 Letters in parentheses used to identify listings in text or subdivisions of illustrations, (*a*), (*b*), (*c*), etc.

G20.1.4 The following in chemistry: *N* (normal), *M* (molar), *c* (concentration). Do not italicize symbols for the elements (Fe, N, Na, etc.). Exception: italicize *N* for nitrogen when it is used to denote position, as in *N*-methylaniline. Italicize *o*, *m*, and *p* as ortho, meta, and para; for example, *p*-cresol. Italicize and abbreviate secondary and tertiary as *sec* and *tert*; for example, *tert*-butyl alcohol. Italicize *iso* when used in *iso*octane.

G20.1.5 Titles of books, including ASTM books, such as *Annual Book of ASTM Standards*, *Proceedings*, and *ASTM STP 379*.

G20.1.6 The words (*left*), (*right*), (*top*), (*bottom*), (*left to right*), etc. used in figure captions.

G20.1.7 Foreign words. Use *Webster's Ninth New Collegiate Dictionary* as a guide to foreign words. The entry in the dictionary is preceded by two vertical bars.

G20.1.8 Transistor type. Use *n-p-n*, *p-n-p*, *n*-type, etc.

G20.2 Do not italicize:

G20.2.1 Letters used to subdivide a categorical classification, such as Method A, Cement B, Class C, Grade D, Type E, Sample F.

G20.2.2 A_1 point, A_3 point, etc. (metallurgy).

G20.2.3 pH, sin, cos, tan, log, d (for derivative).

G20.3 Italics are indicated in typewritten copy by underlining.

G20.4 Follow these conventions, taken from ANSI Y10, General Principles of Letter Symbol Standardization:

"Symbols for physical quantities, mathematical variables, indices, and general functions are printed in italic (sloping) type, e.g.:

A	area
e	charge of an electron
x, y, z	cartesian coordinates
i, j, k, n	indices
$f(x)$	function of x

"Symbols for physical units, mathematical constants, specific mathematical functions, operators, and numbers used as indices are printed in roman (upright) type, e.g.:

cm	centimeter
e	base of natural logarithms
$\sin x$	sine of x
$\mathrm{J}_0(z)$, $\mathrm{J}_n(z)$	Bessel functions
$\mathrm{d}x$	differential

"Subscripts and superscripts are governed by the above principles. Those that are letter symbols for quantities or for indices are printed in italic type, while all others are printed in roman type, e.g.:

C_p	heat capacity at constant pressure p
a_{ik}, a_{ki}	matrix elements
I_i, I_o	input current, output current
x_av	average value of x

"For indicating the vector character of a quantity, boldface italic type is used, e.g.:

F	force
H	magnetic field strength

Ordinary italic type is used to represent the magnitude of a vector quantity. It is also commonly used when there is no need to draw attention to the vector character of the quantity.

When tensor quantities of second or higher order are to be represented by a single letter, sans serif type should be used (for example, ***A***, ***B***)."

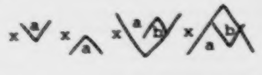
G21. Mathematical Material

G21.1 Whether the mathematical material is typed or written by hand in the manuscript, remember that it will be set in type by a compositor, not a mathematician. The copy submitted must be perfectly clear, without ambiguities arising from carelessly placed subscripts or superscripts, confusion between Greek and Roman letters, incomplete fraction lines, and so on. On most typewriters, the letter "l" and the numeral "1" are the same. To avoid confusion, write the letter by hand, with a loop. When there is a possibility of confusion and you mean "one," write and circle the word "one" lightly above the symbol. The same confusion is possible between the capital letter O and a zero and between capital X and a multiplication sign. Write and circle the word "zero," "oh," or "multi" above the symbol.

G21.2 Be careful of possible confusion between Greek kappa and k, between Greek epsilon and e, between Greek eta and n, etc. In case of doubt, write out the name of the Greek symbol and circle. See Section G16, Greek Alphabet.

G21.3 In hand-written copy, it is easy to confuse capital and lower case c's, o's, p's, u's, v's, and so on. In case of doubt, write and circle "lc" above the symbol, if lower case, or underline it three times if a capital.

G21.4 Superscripts and subscripts (superior and inferior symbols) should be marked on the first copy of the manuscript by a caret or an inverted caret, using a black pencil, as in the illustration following. Subscripts to subscripts and superscripts to superscripts are difficult to set by machine and should be avoided. Subscripts to superscripts and superscripts to subscripts are more easily set, but they are confusing to the reader and should also be avoided if possible. A little ingenuity in the choice of symbols can often eliminate such confusion.



G21.5 The illustration above shows how to mark (*left to right*) a superscript, a subscript, a subscript to a superscript, and a superscript to a subscript.

G21.6 If a symbol carries both a subscript and a superscript, expensive handwork is required to align one over the other. Therefore, the superscript should follow the subscript, as in $a_b{}^c$.

G21.7 Type all equations on separate lines.

G21.8 Radical signs require expensive handwork and should be avoided. Use fractional exponents.

G21.9 *Equations*—Equations should be numbered when two or more are included in the text. The standard form for a numbered equation is:

$$S = Mc/I \qquad (1)$$

where:

S = stress, psi or Pa,
M = bending moment, lbf·in. or N·m,
c = distance from neutral axis to outermost fiber, in. or m, and
I = second moment of area, in.^{4} or m^4.

Symbols for physical quantities (quantity symbols) in equations should be consistent with those prescribed in ANSI Y10 standards and should be consistent throughout the standard, regardless of the units employed.

G21.10 *Exp versus e*—If the exponent is relatively short and on one line, without superscripts or subscripts, use e. Example: $e^{(a-bcx)}$. If it is relatively long or has superscripts or subscripts, use exp. Example: $\exp[x^2/2 - \ln(x/a)]$.

G21.11 *Fractions*—The question whether to use the solidus (diagonal line) or the built-up fraction (with a horizontal line) is not clear-cut. Except for simple numerical fractions, the solidus is less expensive to set. Therefore use the following guide:

G21.11.1 Type simple numerical fractions with a horizontal line, since these are easier to read, and they are available, in machine composition.

G21.11.2 In mathematical expressions run in with the text, use the solidus. It is less expensive to set, does not intrude upon the lines above and below, and makes for a better appearance. Use parentheses liberally so as to show clearly what is the complete numerator or denominator. For example, does log a/b mean log (a/b) or (log $a)/b$? Use the parentheses to clarify. If you write $a/b + c$ but mean $a/(b + c)$, use parentheses.

G21.11.3 As the expression gets longer, the solidus becomes awkward and difficult to read; then use the built-up fraction. If you use a built-up fraction on one side of an equation, however, use it on both sides.

That is, do not write

$$a/b = \frac{c - d}{e - \frac{f}{2}} \times 12$$

Instead, write

$$\frac{a}{b} = \frac{c - d}{e - \frac{f}{2}} \times 12$$

G21.12 *Statistical Data*—For data that are treated statistically, follow the recommendations in the *ASTM Manual on Presentation of Data and Control Chart Analysis (STP 15 D)*. In particular:

G21.12.1 To present the essential information contained in a set of observations from one population, give the average, the standard deviation or coefficient of variation, and the number of observations.

G21.12.2 Whenever you give an average, give also the number of observations on which the average is based.

G21.12.3 Use the following symbols, where needed:

$\bar{X}$ = average (arithmetic mean)
σ = root-mean square deviation
n = number of observations
s = standard deviation
v = coefficient of variation

G21.12.4 Committee E-11 on Statistical Methods, which is responsible for *STP 15 D*, is prepared to cooperate with other technical committees in helping them present data most effectively.

G22. Metric Conversion

G22.1 Metric (SI) units shall be included in all new manuscripts and revisions of ASTM standards in accordance with the latest edition of Metric Practice Standard E 380 (Vol 14.02) and Part H, Use of Metric (SI) Units in ASTM Standards, of this publication.

G22.2 *"M" Standard (Definition—see H2)*—An exception to G22.1 is in the case where "M" standards have been written (see A3.4 or B4.4). Metric units are usually deleted from standards having a metric companion. In this case an appropriate note is inserted in the scope, as follows:

NOTE X—A complete metric companion to Specification A 000 has been developed—A 000M; therefore, no metric equivalents are shown in this specification.

The note used with the companion metric ("M") document is:

NOTE—This specification is the metric companion of Specification A 000.

G23. Multiples and Submultiples

G23.1 The International Committee on Weights and Measures has adopted the following prefixes for denoting multiples and submultiples of SI units (see Metric Practice Standard E 380):

Multiple	*Prefix*	*Symbol*
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

G24. Notes (See also A25, B28)

G24.1 Notes appearing in a given standard should be numbered in sequence, regardless of the number of the section in which they appear. *Exception:* For definitions see A25.2, B28.2. These notes should appear at the end of the paragraph to which they pertain. If it is desired to refer to a text note in connection with a specific word or phrase in the text, that word or phrase should be followed by a reference to the note, "(Note 1)," etc.

G25. Numbering

G25.1 *Text Divisions*—Refer to the Guide to the Use of the Modified Decimal Numbering System, Part D of this publication, for instructions for numbering text divisions.

G25.2 For other sections on numbering see G14, Footnotes, G24, Notes, G33, References, G38, Tables.

G26. Numerals

G26.1 Use arabic numerals in designating figures and tables, thus: "Fig. 3," "Table 6."

G26.2 Spell out all numbers from one through twelve, with the following exceptions:

G26.2.1 Use numerals when the quantity is partly fractional, as: 1.15, 1½.

G26.2.2 Use numerals when followed by an expression having a standard unit symbol, as: 25 mm, 45 kg, 9 %.

G26.2.3 If for any reason the standard abbreviation or unit symbol of the expression following the number is not used, or if the expression does not admit of abbreviation (as *year*, *ton*, etc.) the use of numerals is optional, unless covered in the following paragraphs.

G26.2.4 In contrasting statements, if some numbers must be numerals, use numerals for all, as "2 tests and 16 weighings."

G26.2.5 In a series of connected numerical statements implying precision, use numerals, as "5 months, 3 days."

G26.2.6 Use numerals after abbreviations, as: Vol 26, Fig 2.

G26.3 Use numerals for all numbers exceeding twelve, with the following exceptions:

G26.3.1 Do not begin a sentence with a numeral. When the numeral is spelled out, also spell out the unit following, as "One gram is usually sufficient."

G26.3.2 Round numbers used in an indefinite sense shall be spelled out: as, "A *hundred* metres or so."

G26.3.3 Spell out numbers when used in the following manner: "*fifteen* 25-mm rods," (or 15 twenty-five-millimetre rods).

G26.4 In decimal numbers having no units, place a zero before the decimal point, as: "0.65 mm", not ".65 mm."

G26.5 In pointing off numbers of more than four figures, use spaces instead of commas in the text, illustrations, and tabular matter (1 234 567). Do not point off numbers of four figures (1234) except in tables when they occur in a column containing numbers of more than four figures.

G26.6 In expressing ratios use 1 to 10 or 1:10, not 1-10.

G26.7 In expressing grades of, for example, emery paper, use 3/0, not 000.

G27. Percent versus Percentage Points

G27.1 When a quantity is reduced from 40 to 30, it is reduced by 25 %. When it decreases from 40 % to 30 %, it decreases by 10 *percentage points*. Use the forms "mass percent," "volume percent," "atom percent," etc.

G28. Photomicrographs

G28.1 See Section G18, Illustrations (Figures) and Captions.

G29. Polymers

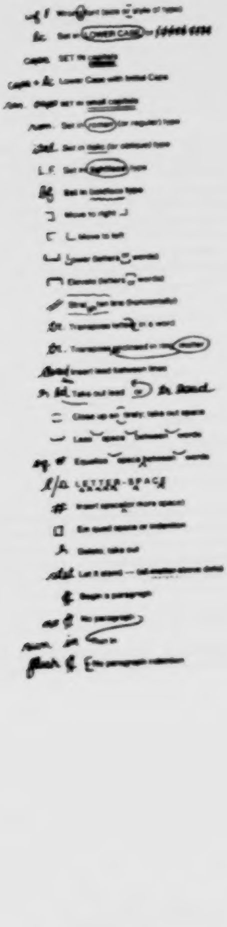
G29.1 Where the name of the monomer is one word, the prefix "poly" is simply run in, as: polystyrene, polyisobutylene, etc. Where the name of the monomer is two words, they are enclosed in parentheses and the prefix "poly" added, as in the following words: poly(vinyl chloride), poly(methyl methacrylate).

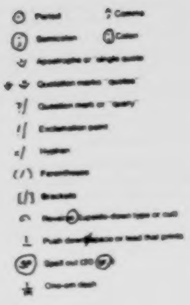
G30. Powers of 10

G30.1 Do not use notation such as "$\times 10^{n}$" in table column headings or in ordinate or abscissa legends on illustrations. It is ambiguous. One cannot tell whether the scale has been or should be multiplied by 10^6. Instead, use "$\times 10^6$" alongside the first entry in the table or the largest number in the ordinate or abscissa scale. It is also permissible to write, for example, "thousand h" or "million psi" in the table heading or the legend for the ordinate or abscissa.

G31. Proofreader's Marks

G31.1 The following are accepted proofreading symbols. Editing marks on manuscripts are indicated directly within the body of the manuscript. On typeset proofs the marks are written in the margins.





G32. Quotations

G32.1 Long quotations (a paragraph or more) may be marked to be set in one size smaller type without quotation marks.

G33. References (See also A22, B25)

G33.1 If there are fewer than five references cited in the standard, use footnotes. If five or more references are cited, type them in a separate list of references at the end of the manuscript, following annexes and appendixes, if any. Assign a one-part consecutive number to each reference. Indicate the reference in the text by an arabic boldface number enclosed in parentheses.

G33.2 When a separate list is required, it is usually possible to designate references in the text simply by inserting the boldface number in parentheses in the appropriate place. Show a footnote reference after the first boldface reference number, stating in the footnote: "The boldface numbers in parentheses refer to the list of references at the end of this standard." If it is necessary to use the word "reference," use the style: "According to Ref (3). . . ." It is preferable, however, to use the author's name, as: "According to Jones (3). . . ." If there are two authors, use both names, as: "According to Jones and Smith (3). . . ." If there are three or more authors, use "et al," as: "According to Jones et al (3). . . ."

G33.3 Do not list ASTM standards as references; list them in the section on Referenced Documents. Do not list as references documents that are not readily accessible to the reader, such as unpublished theses, private correspondence, etc.

G33.4 Type references (and publication footnotes) as follows:

G33.4.1 *Books*—Type author's name or names (initials last), title of book (underline, no quotation marks), name of publisher, address of publisher (city and state), year of publication, and page number, if reference is to a page number. Example: Jones, J. J., *Plasticity and Creep*, John Wiley & Sons, Inc., New York, NY, 1958, p. 250.

G33.4.2 *Magazines, Journals* (including *Standardization News*)—Type author's name or names (initials last), title of paper (in quotation marks), complete title of journal (underline, no quotation marks), volume number, issue number (this may be omitted if the journal page numbers are continuous throughout the volume), date of publication, and page numbers. Example: Jones, J. J., and Smith, R. R., "Correlation of Brinell Hardness and Tensile Strength," *Materials in Design Engineering*, Vol 10, No. 2, February 1958, pp. 52–67.

G33.4.3 *Proceedings, Transactions, Reports, Bulletins, etc.*—Type author's name or names (initials last), title of paper (in quotation marks), name of publication (underline, no quotation marks), name of publisher, volume number, if any, date of publication, and page numbers. Examples:

Jones, J. J., "Lubrication Problems in Space Vehicles," *Transactions*, Am. Soc. Mechanical Engrs., Vol 52, 1948, pp. 135–140.

Jones, J. J., "Classification of Bitumens," *Journal* Inst. Petroleum, Vol 38, 1952, p. 121.

Jones, J. J., "Fatigue of Aircraft Structures," *NASA TR-108*, Nat. Aeronautics and Space Administration, 1959.

Jones, J. J., "Effect of Carbon Content on Notch Properties of Aircraft Steels," *Bulletin 642*, Engineering Experiment Station, University of Illinois, 1957.

G33.4.4 *Symposium Volumes or Other Books Comprising Collections of Papers*—Follow style for books in G33.4.1 and add title of paper, in quotes, after author's name.

G33.4.5 *Patents*—Type patent number and date. Example: U.S. Patent No. 2 232 185, Feb. 18, 1941.

G33.4.6 *Annual Book of ASTM Standards*—Cite referenced ASTM standards in section on Referenced Documents, not in references (see G14.4).

G33.4.7 *ASTM Proceedings*—McVetty, P. G., "The Interpretation of Creep Tests," *Proceedings*, ASTM, Vol 34, Part II, 1934, p. 105.

(Volume 38 was the last to be issued in two parts.)

G33.4.8 *ASTM Special Technical Publication*

G33.4.8.1 *Single Paper*

Ransom, J. T., and Mehl, R. F., "The Statistical Nature of the Fatigue Properties of SAE 4340 Steel Forgings," *Symposium on Fatigue with Emphasis on Statistical Approach, ASTM STP 137*, ASTM, 1952, p. 3.

G33.4.8.2 *Whole Book*

Symposium on Fatigue with Emphasis on Statistical Approach, ASTM STP 137, ASTM, 1952, p. 3.

G34. Sample versus Specimen

G34.1 In general, the word "sample" should be used only to describe a piece or quantity of bulk material that has been selected by some sampling process. Pieces or quantities taken from the sample for testing are called "specimens." Quantities of liquid or bulk aggregate are usually called "samples," because a sampling procedure is usually used to obtain them.

G34.2 To describe the piece on which a test is made, use "specimen" or "test specimen," not "piece" nor "sample."

G35. Spelling

G35.1 Included in the following list are only spellings that *(1)* differ from the spelling in *Webster's Ninth New Collegiate Dictionary*, *(2)* are not clearly indicated as preferred in the dictionary, or *(3)* may not appear in the dictionary but are listed here for convenience. For words that do not appear in this list, use the dictionary.

A

acidproof
admiralty metal (lc)
airborne
airtight
alclad (lc)
alignment
Aloxite (trademark, use aluminum oxide)
Alundum (trademark)
antioxidant
appendixes (pl)

B

babbitt metal (lc)
Bakelite (trademark)
Brinell (cap)
briquet
bunsen (lc)
buret
burnup

C

Carborundum (trademark)
catalog
Celite (trademark)
Chromel-Alumel (trademark)
CODEN

D

disk
drier (comp. of dry)
dryer (apparatus)

E

embed
endorse
end point
ensure (meaning be sure)
equiaxial
et al
eutectic (noun)
eutectoid (adj)

F

feedwater
fiber
fiber glass
fire clay (noun)
fireclay (adj)
flowmeter
freezing-and-thawing test

G

gage (measurement)
gastight
gauge (tempering plaster)

Geiger-Müller tube
gray (not grey)
ground water

H

half-life
Haydite (trademark)
heat treat (verb)
heat-treated (adj)
Hooke's law (lc "l")
hot-short (metallurgy)

I

Inconel (trademark)
indexes (pl)
in situ (roman)
insofar
Invar (trademark)
*iso*octane (all other "iso's" roman)

K

Kel-F (trademark, use polychlorotrifluoroethylene)
kerosine

L

litre
Lucite (trademark, use poly(methyl methacrylate) (PMMA))

M

machinability
magnetic particle inspection (not Magnaflux)
Magne-Gage (trademark)
Masonite (trademark)
metre
microscopic (meaning very small)
microscopical (meaning pertaining to use of a microscope)
mold
Monel metal (trademark)
Midcontinent oil
Muntz metal (trademark)
Mylar (trademark, use polyester film)

N

neoprene (lc)
Nichrome (trademark)
nital (lc)
nitrile rubber (butadiene) (lc)
Normal Law integral (cap N and L)
Nujol (trademark, use light mineral oil)

O

O-ring

P

percent
pipet
plaster of paris
Plexiglas (trademark, use poly(methyl methacrylate) (PMMA))
poly(vinyl chloride)
pozzolan
Pyrex (trademark, use borosilicate)

R

Rockwell (cap)
rustproof (adj)
rust proof (verb)

S

saran (lc)
scleroscope (lc)
Scotch tape (trademark, use pressure-sensitive tape)
sigma phase (spell out sigma)
siliceous
skillful
SR-4 strain gage
status quo
stopwatch
Stokes' law (lc "l")
sulfur
summerwood

T

Teflon (trademark, use TFE-fluorocarbon or polytetrafluoroethylene (PTFE)
Thiokol (trademark, but not a noun: use as an adjective, as "Thiokol polysulfide rubber")
Transite (trademark)
Tygon (trademark, use vinyl)

U

underburned
usage

V

Vaseline (trademark, use petroleum jelly)
viscometer
V-notch (noun and adj)
Vycor (trademark, use high-silica)

W

watchglass
waterline
watertight
wavelength
wavemeter
wave number

X

X ray (noun)
X-ray (adj and verb)

G36. Standards, Reference to

G36.1 Refer to ASTM standards first in the section on Referenced Documents. Follow the designation (without year) with the full title, and use a footnote to refer to the appropriate publication. The footnote should read, for example, "*Annual Book of ASTM Standards*, Vol 06.01." Thereafter use simply the abbreviated designation (Test Method D 1708, Practice E 691, Specification A 430, etc.). Do not include the word "Standard." Do not use quotes on titles of standards, whether those of ASTM or other organizations.

G36.2 Do not refer to a specific paragraph or section of another standard unless necessary to avoid confusion. For example, say, "the sections on Impregnation Time of Methods D 202."

G37. Symbols

G37.1 In general, avoid the use of symbols in text except in accordance with Sections G3 and G7. When stating dimensions, use "by" not ×, for example, "10 by 5 in. (254 by 127 mm)." Show tolerances, for example, as 10 by 5 ± ¼ in. (254 by 127 ± 6 mm)." Do not use a hyphen or a dash for the word "to" except in tables where needed to conserve space.

Do not use (′) or (″) for feet and inches in either text, tables, or figures.

G37.2 In combination with words not having symbols, spell out entirely, for example, "bubbles per minute."

G38. Tables

G38.1 Number each table with an arabic numeral and give it a title that is complete and descriptive. Type the table number and title above the body of the table.

G38.2 In column headings, first write the quantity being tabulated, then a comma, then the units. Example: "Tensile Strength, min, psi."

G38.3 Do not use powers of 10 in the column heading, since it is not clear whether the numbers in the table have been or should be multiplied by the power of ten. Instead, indicate the multiplication (for example, 1.45×10^6) in the first entry in the table; or use an expression such as "Young's Modulus, millions of psi" in the column heading.

G38.4 Indicate footnotes in tables with a superior, capital letter. Type the footnotes below the table.

G38.5 Where clarity is not sacrificed, rule tables horizontally only at beginning and end and after column headings. Use vertical rules only when the complexity of the table demands them for clarity. Put three periods in any space that represents a blank entry.

G39. Tension Test

G39.1 The words "tension," "compression," and "flexure" are used adjectivally to modify "specimen," "test," or "testing." Examples: tension test, compression testing, flexure specimen. To modify other nouns, the adjectives "tensile," "compressive," and "flexural" are used. Examples: tensile strength, compressive force, flexural data.

NOTE G1—In some areas (notably the textile industry) there is a difference between a "tension test" and a "tensile test," and in these cases the appropriate terminology shall be used.

G40. Thermal Conductivity

G40.1 The form to be used for the unit for thermal conductivity, *k*, is: Btu·in./h·ft^2·°F [SI units: W/(m·K)].

G41. Thermometers

G41.1 Whenever possible, refer to thermometers described in ASTM Specification E 1, for ASTM Thermometers (Vol 14.01). Reference to an ASTM thermometer of the desired range should be as follows:

Thermometer—ASTM (name) Thermometer having a range from — to — (°C or °F, whichever applies) and conforming to the requirements for Thermometer (give thermometer number: for example, 16F) as prescribed in Specification E 1.

G41.2 Do not specify both temperature scales unless there is a definite need for them.

G42. Trademarks

G42.1 Avoid the use of trademarks whenever possible. For example, use aluminum oxide instead of Aloxite, petroleum jelly instead of Vaseline. When trademarks must be used, they should, of course, be initial cap and the owner of the trademark indicated by footnote. See Section F4.

PART H
USE OF METRIC (SI) UNITS IN ASTM STANDARDS

H1. Scope

H1.1 These instructions are to guide technical committees when preparing ASTM standards and supplementary metric practice guides for the use of the International System of Units (SI) by following ASTM Standard E 380 for Metric Practice.

H1.2 For the guidance of a technical committee that desires to have a metric practice guide that supplements ASTM E 380, rules for the preparation of such are given in Section H7.

NOTE H1—Each volume of the *Annual Book of ASTM Standards* contains an excerpt from ASTM E 380 in the Related Material section. ASTM E 380 appears in its entirety in Volume 14.02, and is also available as a separate publication. Additional guidance may be obtained from Committee E-43 on Metric Practice.

H2. Descriptions of Terms

H2.1 *acceptable metric units*—metric units comprising two categories of units described in ASTM E 380 as follows:

H2.1.1 *SI units*—units of the International System of Units (SI);

H2.1.2 *approved units*—units specifically approved in ASTM E 380 as units for use with SI.

H2.2 *other units*—units that comprise the following classifications:

H2.2.1 *inch-pound units*—units based on the yard and the pound, commonly used in the United States of America and defined by the National Bureau of Standards, including certain other units accepted for use with these units such as the degree Fahrenheit.

H2.2.2 *non-recommended metric units*—units whose use is deprecated or not recommended in ASTM E 380. This category includes units such as: micron, kilogram-force, calorie, torr, erg, dyne, gal, poise, stokes, stilb, phot, gauss, oersted, mho, maxwell, gilbert, biot, and franklin.

H2.2.3 *other non-recommended units*—other units not recommended in ASTM E 380, such as: metre of water, standard atmosphere, and grade.

H2.3 *soft conversion*—the process of changing the description of an existing measurement to acceptable metric units without a significant change in size or in magnitude.

H2.4 *hard conversion*—the process of changing the description of an existing measurement to acceptable metric units but with a change in the size of an existing object or the magnitude of an existing quantity to obtain standard, convenient, rounded, or rationalized metric dimensions. Such change may make the changed object or quantity not interchangeable with the original.

H2.5 *rationalization*—planned simplification by reducing the number of item configurations and by relating such configurations in a rational manner, usually in a preferred number progression, or in a series of preferred sizes.

H2.6 *metric standard*—a standard written completely and solely in acceptable metric units.

H2.6.1 *"M" standard*—a metric standard that is a companion to a standard on the same subject written in any other units. Identification is made by adding an M after the number in the designation.

Example: Method B 557 and Method B 557M.

NOTE H2—Cross-references should be given both in the "M" standard and in the companion standard with a text note to acknowledge the existence of the other.

Examples:

1. *Other Unit Standard:* NOTE X—A complete metric companion to Specification A 000 has been developed—A 000M; therefore, no metric equivalents are shown in this specification.
2. *"M" Standard:* NOTE Y—This specification is the metric companion of Specification A 000.

H3. Requirements

H3.1 Every ASTM standard shall use or include acceptable metric units (H2.1). If the standard is written in acceptable metric units, no other units are required. If the standard includes other units (H2.2), one of several alternatives must be adopted.

H3.1.1 The preferred alternative is to prepare a companion standard (H2.6.1) solely in acceptable metric units that will exist in parallel with the standard containing other units, until such time as the latter may be withdrawn. During the time that both exist, the one using solely acceptable metric units shall be indicated by an "M" following the number (see A3.4.1 or B3.4.1).

H3.1.2 A second alternative is to include both acceptable metric units and other units in the same standard with either system of units being acceptable for consistent use throughout the standard (see A3.4.2 or B3.4.2).

H3.1.3 A third alternative is to write the standard by using other units but by including acceptable metric units as information. The other units shall be indicated as standard.

H4. Rules for Introducing Acceptable Metric Units

H4.1 Acceptable metric units of measurement shall be included in all ASTM standards except those that have a companion "M" standard. Where there is no direct acceptable metric equivalent, such as screw threads, or where a design matches an item only in other units, the equivalent may be omitted; however, an appropriate note to that effect shall be inserted.

H4.2 Each technical committee shall have the option of giving preference to acceptable metric units or to other units.

H4.2.1 When preference is given to acceptable metric units, other units may be omitted.

H4.2.2 When the standard allows alternative units to be used without preference, acceptable metric units shall be placed first.

H4.2.3 When preference is given to other units, the acceptable metric units shall be given in parentheses or brackets, in a dual-unit table, in a supplementary table, in a footnote, in an annex, or by the use of conversion factors.

H4.3 When dual units are given in a standard, the system of units to be used as standard shall be that given in the preferred position of each standard unless otherwise stated in the scope of the standard. Examples of such explanatory statements are as follows:

H4.3.1 The values stated in acceptable metric units are to be regarded as the standard.

H4.3.2 The values given in parentheses are provided for information purposes only.

H4.3.3 The values stated in either acceptable metric units or in other units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

H4.4 The calculated acceptable metric unit value to an other unit value should be rounded to the proper number of significant digits as described in the applicable section of ASTM E 380. This is especially true for nominal dimensions; for example, a value such as "1-in. clearance" may be shown as "25-mm clearance," and "about 20 in." may be shown as "about 500 mm." In general, the acceptable metric unit dimensions should be a hard conversion, including use of a rationalized series of sizes from other ASTM standards (such as those covering round metal bars, for example) and not be a mere soft conversion.

H4.5 In standards that have alternative or optional procedures based on apparatus graduated or dimensioned in either acceptable metric units or other units, converted values need not be included. If the optional procedures or dimensions produce equally acceptable results, the options may be shown by using the word "or" rather than parentheses; for example, in a 2-in. gage length metal tension-test specimen, the gage length may be shown as "2 in. or 50 mm."

H4.6 For soft conversion, a specific repetitive equivalent, for example, 1.00 in. (25.4 mm), need be inserted only the first time it occurs in each paragraph of a standard.

H4.7 When a standard specifies that results should be expressed in another unit in a general sense, the preferred acceptable metric unit should be stated. For example, "Report the twist of yarns in twists per inch (twists per metre)", not "... in twists per inch, (25.4 mm)."

H4.8 For methods of including acceptable metric units in tables, see Section H5.

H4.9 On illustrations the dimensions may be indicated by letters with the corresponding values and units shown in an accompanying table (H6.4), or the dimensions in which the item was originally designed may be shown in the illustration and the corresponding units in an adjacent table (H6.5). In the case of charts or graphs, dual scales may be used to advantage.

H4.10 The need for equivalents can be eliminated in the case of tolerances if the limits are expressed in percentages.

H4.11 For standard sieve sizes, use the values given in Table 1 of Specification E 11, for Wire-Cloth Sieves for Testing Purposes (Vol 14.02).

H4.12 Where it has been long-standing practice to use acceptable metric units alone (such as stating temperatures only in degrees Celsius), equivalents may be omitted.

H5. Introducing Acceptable Metric Units in Tables

H5.1 *Case 1. Limited Tabular Material*—Provide acceptable metric unit equivalents in tables in parentheses or brackets or preferably in separate columns as illustrated below:

TABLE H1 Mechanical Properties[A] of Small-Diameter and Light-Wall Tubing (Converter Sizes)

Condition	Tensile Strength, psi (MPa)	Yield Strength (0.2% offset),[B] min, psi (MPa)	Elongation in 2 in. or 50 mm, min, %	Rockwell Hardness[C] (or Equivalent)
		Nickel		
Annealed[D]	75 000 (515) max	15 000 (105)	33	B 70 max
Half-hard[E]	80 000 (550) min	40 000 (275)	12	B 75 to B 90
Full-hard[F]	95 000 (655) min	75 000 (515)	4	B 90 to C 30
		Low-Carbon Nickel		
Annealed[D]	70 000 (485) max	12 000 (85)	35	B 62 max
Half-hard[E]	70 000 (485) min	30 000 (205)	12	B 70 to B 85
Full-hard[F]	85 000 (585) min	65 000 (450)	4	B 80 to B 95

[A] Not applicable to outside diameters under ⅛ in. (3.2 mm) and wall thickness under 0.015 in. (0.38 mm).

[B] See 14.3.

[C] Hardness values, indicative of tensile strength, are shown for information only. All tests are subject to confirmation by tension tests. For hardness conversions see Hardness Conversion Tables E 140.

[D] This condition is sometimes designated as "No. 1 Temper."

[E] This condition is sometimes designated as "No. 2 Temper."

[F] This condition is sometimes designated as "No. 3 Temper."

TABLE H2 Typical Properties

Density		Tensile Strength		Elongation in 1 in. or 25 mm, %	Yield Point in Compression (0.1% offset)		Hardness HRH
lb/ft³	Mg/m³	psi	MPa		psi	MPa	
360	5.8	29 500	205	0.5	28 500	195	85
385	6.2	34 000	235	1	30 000	205	90

H5.2 *Case 2, One or Two Large Tables*—When the size of a table and limitations of space (on the printed page) make it impractical to expand the table to include acceptable metric unit equivalents, the table should be duplicated in acceptable metric units, and in other units as shown below. If this procedure will result in increasing the standard by more than three pages, apply Case 3 or Case 4 as applicable.

TABLE H3 Size and Wall Thickness Ranges

NPS Designator	Outside Diameter	Nominal Wall Thickness					
		Schedule 100		Schedule 120		Schedule 160	
		Wall Thickness	Length Range	Wall Thickness	Length Range	Wall Thickness	Length Range
Inch-Pound Units							
	in.	in.	ft	in.	ft	in.	ft
½	0.840	...	...	...	...	0.187	...
¾	1.050	...	...	...	...	0.218	...
1	1.315	...	...	...	...	0.250	...
1¼	1.660	...	...	...	...	0.250	...
2	2.375	...	...	...	...	0.343	...
2½	2.875	...	...	...	...	0.375	...
3	3.500	...	...	...	...	0.438	...
4	4.500	...	...	0.438	...	0.531	...
6	6.625	...	...	0.562	...	0.718	...
8	8.625	0.593	...	...	...	0.906	...
10	10.750	0.718	25 to 30	...	...	1.125	15 to 25
12	12.750	0.843	20 to 30	...	...	1.312	15 to 25
14	14.000	0.937	20 to 30	...	...	1.406	15 to 25
16	16.000	1.031	18 to 30	...	...	1.593	10 to 25
SI Units							
	mm	mm	m	mm	m	mm	m
½	21.34	...	...	...	...	4.76	...
¾	26.67	...	...	...	...	5.56	...
1	33.40	...	...	...	...	6.35	...
1¼	42.16	...	...	...	...	6.35	...
2	60.33	...	...	...	...	8.73	...
2½	73.03	...	...	...	...	9.53	...
3	88.90	...	...	...	...	11.11	...
4	114.3	...	...	11.11	...	13.49	...
6	168.3	...	...	14.29	...	18.26	...
8	219.1	15.08	...	...	...	23.02	...
10	273.1	18.26	7.6 to 9.1	...	...	28.58	4.6 to 7.6
12	323.9	21.43	6.1 to 9.1	...	...	33.33	4.6 to 7.6
14	355.6	23.81	6.1 to 9.1	...	...	35.72	4.6 to 7.6
16	406.4	26.19	5.5 to 9.1	...	...	40.46	3.0 to 7.6

H5.3 *Case 3, Extensive Tabular Material*—When the number of tables requiring duplication of acceptable metric unit equivalents, as in Case 2, would increase the size of the printed standard by more than three pages, prepare a summary annex listing all of the units that appear in the various tables along with the acceptable metric equivalents; these shall be selected with great care following the rules of Section H4, especially H4.4. If this procedure would result in an increase of the standard by more than one page, apply Case 4.

H5.4 *Case 4, Unusual Number of Large Tables*—When Case 2 or 3 does not apply because of the size and number of tables, include the pertinent conversion factors in a footnote under each table, as in the following illustration:

TABLE H4

NPS Designator	Outside Diameter, in.[a]	Wall Thickness in.[a]	Nominal Weight per ft Plain End, lb[b]	Weight Class	Schedule No.	Test-Pressure,[c] psi		
						Butt-Welded	Grade A	Grade B
⅛	0.405	0.068	0.24	STD	40	700	700	700
		0.095	0.31	XS	80	850	850	850
¼	0.540	0.088	0.42	STD	40	700	700	700
		0.119	0.54	XS	80	850	850	850
⅜	0.675	0.091	0.57	STD	40	700	700	700
		0.126	0.74	XS	80	850	850	850
½	0.840	0.109	0.85	STD	40	700	700	700
		0.147	1.09	XS	80	850	850	850
		0.188	1.31	...	160	900	900	900
		0.294	1.71	XXS	...	1000	1000	1000
¾	1.050	0.113	1.13	STD	40	700	700	700
		0.154	1.47	XS	80	850	850	850
		0.219	1.94	...	160	950	950	950
		0.308	2.44	XXS	...	1000	1000	1000
1	1.315	0.133	1.68	STD	40	700	700	700
		0.179	2.17	XS	80	850	850	850
		0.250	2.84	...	160	950	950	950
		0.358	3.66	XXS	...	1000	1000	1000
1¼	1.660	0.140	2.27	STD	40	1000	1200	1300
		0.191	3.00	XS	80	1300	1800	1900
		0.250	3.76	...	160	1350	1900	2000
		0.382	5.21	XXS	...	1400	2200	2300
1½	1.900	0.145	2.72	STD	40	1000	1200	1300
		0.200	3.63	XS	80	1300	1800	1900
		0.281	4.86	...	160	1350	1950	2050
		0.400	6.41	XXS	...	1400	2200	2300
2	2.375	0.154	3.65	STD	40	1000	2300	2500
		0.218	5.02	XS	80	1300	2500	2500
		0.344	7.46	...	160	1400	2500	2500
		0.436	9.03	XXS	...	1400	2500	2500

[a] 1 in. = 25.4 mm (exact).
[b] 1 lb/ft = 1.488 164 kg/m.
[c] 1 psi = 6.894 754 kPa.

H5.5 *Case 5, Large and Small Tables Representing a Combination of Two or More of the Preceding Cases*—When a standard contains some small tables and several full-page tables, representing a combination of the preceding cases, insert the acceptable metric unit equivalents in the small tables and apply the rules for Cases 2 through 4, as applicable, for the remaining tables.

H6. Submittal of Acceptable Metric Units for Existing Standards

Note in the following examples that when preference is given to acceptable metric units the other units are placed in parentheses and when preference is given to other units the acceptable metric units are placed in parentheses.

H6.1 For text material, show the other unit or acceptable metric unit equivalent in the margin of a reprint or photocopy, as illustrated below:

> *Mixture*—The mixture shall be of such quality that the pipe will conform to the test and design requirements of this specification. In no case, however, shall a proportion of portland cement in the mixture be less than 350 kg/m³ of concrete (564 lb/yd³)
>
> Crawl spaces underneath such subfloors shall be well ventilated and have a clearance of at least 18 in. (460 mm) between the ground level and the joists. A vapor barrier shall be placed on the ground under the wood to reduce the amount of moisture to which the floor will be exposed. Joints in the vapor barrier shall be overlapped at least 6 in. (150 mm)

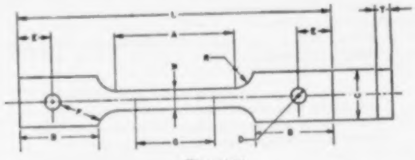
H6.2 For tables where there is sufficient space insert the acceptable metric unit equivalents, as illustrated below:

Wall Thickness		Elongation in 2 in. or 50 mm, min, %
in.	mm	
5/16 (0.31)	7.9	30.0
9/32 (0.28)	7.1	28.5
1/4 (0.25)	6.4	27.0
7/32 (0.22)	5.6	25.5
3/16 (0.19)	4.8	24.0
5/32 (0.16)	4.0	22.5
1/8 (0.12)	3.2	21.0
3/32 (0.09)	2.4	19.5
1/16 (0.06)	1.6	18.0

NOTE H3—This illustration assumes a soft conversion is acceptable; see Section H4, especially H4.4.

H6.3 For tables where space does not permit the acceptable metric unit equivalents to be added, retype the table.

H6.4 For new illustrations it is preferable to indicate the dimensions with letters, as illustrated below:



Dimensions

	in.	mm
G—Gage length	2.000 ± 0.005	50.0 ± 0.10
W—Width (Note 1)	0.500 ± 0.010	12.5 ± 0.25
T—Thickness, max (Note 2)	⅝	16
R—Radius of fillet, min (Note 3)	½	13
L—Over-all length, min	8	200
A—Length of reduced section, min	2¼	60
B—Length of grip section, min	2	50
C—Width of grip section, approximate	2	50
D—Diameter of hole for pin, min (Note 4)	½	13
E—Edge distance from pin, approximate	1½	38
F—Distance from hole to fillet, min	½	13

NOTE 1—The ends of the reduced section shall differ in width by not more than 0.002 in. (0.05 mm). There may be a gradual taper in width from the ends to the center, but the width at each end shall be not more than 0.005 in. (0.13 mm) greater than the width at the center.

NOTE 2—The dimension *T* is the thickness of the test specimen as stated in the applicable product specifications.

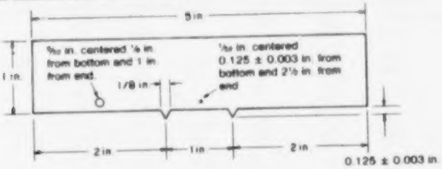
NOTE 3—For some materials, a fillet radius *R* larger than ½ in. (13 mm) may be needed.

NOTE 4—Holes must be on center line of reduced section, within ±0.002 in. (±0.05 mm).

NOTE 5—Variations of dimensions *C*, *D*, *E*, *F*, and *L* may be used that will permit failure within the gage length.

FIG. H1 Pin-Loaded Tension Test Specimen with 2-in. (50-mm) Gage Length

H6.5 For existing illustrations a tabulation of acceptable metric unit equivalents may be inserted beneath the illustration, as illustrated below:


5 in
5/32 in. centered 1/8 in from bottom and 1 in from end
1/32 in. centered 0.125 ± 0.003 in. from bottom and 2½ in. from end
1 in.
1/8 in
2 in
1 in
2 in
0.125 ± 0.003 in

Metric Equivalents

in.	mm	in.	mm
1/32	0.8	1	25.4
⅛	3.2	2	50.8
0.125 ± 0.003	3.18 ± 0.08	2½	63.5
5/32	4.0	5	127

FIG. H2 Leveling Device for Adjusting Liquid Level in Test Cup, Height of Taper Above Cup, and Size of Test Flame

NOTE H4—This illustration assumes a soft conversion is acceptable; see Section H4, especially H4.4.

H7. Recommendations for Preparation and Issuance of Supplementary Metric Practice Guides

H7.1 *Scope*—This section establishes guidelines and recommendations for preparing Supplementary Metric Practice Guides. These guides will provide for metric practices specifically related to ASTM standards over which a committee has jurisdiction.

H7.2 *Responsibility for Preparation*:

H7.2.1 Each ASTM committee, if it deems necessary, should prepare a Supplementary Metric Practice Guide to minimize deviations from ASTM E 380 and encourage the selection and consistent use of preferred units and numbers.

H7.2.2 Supplementary Metric Practice Guides may be prepared by any ASTM subcommittee when approved by the responsible ASTM main committee.

H7.3 *Requirements for Preparation*:

H7.3.1 Supplementary Metric Practice Guides shall be prepared in accordance with these recommendations.

H7.3.2 Supplementary Metric Practice Guides are limited to standards under the jurisdiction of the ASTM committee that prepares the guide.

H7.3.3 Consideration should be given to the coordination of metric practice with committees responsible for related standards.

H7.4 *Recommended Units*:

H7.4.1 Each Supplementary Metric Practice Guide should include the acceptable metric units, preferred prefixes, and preferred numbers related to the subject or field involved.

H7.4.2 The Supplementary Metric Practice Guide should include conversion factors for converting units to the recommended acceptable metric units. Base, supplementary, and derived unit conversion factors that are already in ASTM E 380 should be kept to a minimum.

H7.4.3 Committee E-43 should be contacted for additional help needed beyond that provided in ASTM E 380.

H7.5 *Precision, Bias, and Tolerances*:

H7.5.1 The recommended precision (number of decimal places or number of significant digits) and tolerances for specific sizes and properties may be included in the guide.

H7.5.2 The recommended precision, bias, and tolerances in acceptable metric units shall be equivalent to the values in the original units, and shall be neither enhanced nor reduced.

H7.6 *Rounding*—Any recommended rounding practice for specified quantities, shall be consistent with that stated in ASTM E 380.

H7.7 *Procedure for Using the Guide*—A Supplementary Metric Practice Guide should contain guidelines, procedures, or recommendations for using the guide in developing new metric standards, or in converting old standards to acceptable metric units, or in other technical work of the committee including:

H7.7.1 Recommendations as to which acceptable metric unit (and prefix) is to be used for each particular application (see H7.4.1).

H7.7.2 Proper use of other units that are applicable and unique to the special field covered by the guide.

H7.7.3 Explanation or precautions involving special practices (H7.8) or conversion factors (H7.4.2), if applicable.

H7.7.4 Rounding practice together with percentage variation, when applicable.

H7.7.5 Recommended precision for specified sizes, when applicable.

H7.8 *Special Practices*—Recognition of and provision for special practices applicable and unique to the field covered by the Supplementary Metric Practice Guide may be included.

H7.9 *Responsibility for Review*:

H7.9.1 All Supplementary Metric Practice Guides including those prepared by subcommittees shall be submitted to Committee E-43 by the responsible ASTM main committee.

H7.9.2 Committee E-43 is responsible for timely review of Supplementary Metric Practice Guides prior to publication to ensure compliance with ASTM E 380 and the requirements of H6.7 and H7.8.

H7.9.3 Each committee should designate an individual to act as liaison with Committee E-43 during review of a Supplementary Metric Practice Guide.

H7.10 *Publication*:

H7.10.1 Supplementary Metric Practice Guides will be published in the Related Material section ("gray pages") as supplements to ASTM E 380 in the appropriate volume of the *Annual Book of ASTM Standards*.

H7.10.2 Supplementary Metric Practice Guides shall be identified by title and the phrase "Committee X Supplement to E 380", for example, "Abbreviated Metric Practice Guide for the Roofing Industry/Committee D-8 Supplement to E 380." It will not be assigned an ASTM designation number unless the responsible ASTM committee makes a special request to the Committee on Standards (COS) including the justification why an ASTM designation number is needed. In the latter case, if approved by COS, the Metric Practice Guide will be published as a standard in the appropriate volume of the *Annual Book of ASTM Standards* and include the phrase "Committee X Supplement to E 380."

APPENDIX

X1. EXAMPLES OF ASTM STANDARDS

X1.1 Included in this Appendix are examples of standards illustrating many of the rules of form and style described in the foregoing parts of this manual. Included are examples of a test method, specification, classification, practice, and guide.

	PAGE
Test Method:	
D 4422 - 84, Test Method for Ash in the Analysis of Petroleum Coke (Vol 05.03)	71
Specifications:	
A 812/812M - $83^{\epsilon 1}$, Specification for Steel Sheet, High-Strength, Low-Alloy, Hot Rolled, for Welded Layered Pressure Vessels (Vol 01.03)	73
B 632 - 84, Specification for Aluminum-Alloy Rolled Thread Plate (Vol 02.02) (Ed. Note—A Metric companion to this standard B 632M - 84 is also available and appears in Vol 02.02)	75
Classification:	
D 388 - 84, Classification of Coals by Rank (Vol 05.05)	82
Practice:	
F 499 - 84, Practice for Installation of Wood Underlayment and Preparation of the Surface to Receive Resilient Flooring (Vol 15.04)	88
Guide:	
D 4270 - 83, Guide for Using Existing Practices in Developing and Writing Test Methods (Vol 07.01)	94

APPENDIX

Designation: D 4422 – 84

An American National Standard

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia, Pa. 19103
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If not listed in the current combined index, will appear in the next edition.

Standard Test Method for
ASH IN THE ANALYSIS OF PETROLEUM COKE[1]

This standard is issued under the fixed designation D 4422; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of the ash content of petroleum coke.

1.2 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 346 Methods for Collection and Preparation of Coke for Laboratory Analysis[2]

D 2013 Method for Preparing Coal Samples for Analysis[2]

3. Summary of Test Method

3.1 A representative sample of petroleum coke is dried, ground, and ashed in a muffle furnace at 700 to 750°C (1292 to 1383°F). The residue or ash is expressed as a percentage of the dry petroleum coke.

4. Significance and Use

4.1 The ash content is one of the properties used to evaluate petroleum coke and indicates the amount of undesirable residue present. Acceptable ash content varies with the intended use.

5. Interferences

5.1 High sulfur content of the furnace gases, regardless of the source of the sulfur, may react with an alkaline ash to produce erratic results. The furnace must be swept with air to achieve oxidation and to decrease the sulfur content of the gases.

5.2 Preparation and testing of the analysis sample must neither remove nor add ash. Improper dividing, sieving, and crushing equipment, and some muffle furnace lining material can contaminate the sample.

6. Apparatus

6.1 *Crucibles*, low wide form glazed porcelain or platinum, 30-mL capacity.

6.2 *Muffle Furnace*, with temperature control between 700 and 750°C and equipped with a means to regulate air circulation.

6.3 *Analytical Balance* capable of weighing to 0.1 mg.

6.4 *Drying Oven* controlled at 110 ± 5°C.

6.5 *Desiccator.*

7. Sample Preparation

7.1 Crush the laboratory sample to pass a 6.3 mm (¼ in.) sieve. If the quantity exceeds 5 lb. (2.3 kg), divide the sample to obtain about 5 lb (2.3 kg) and crush this fraction to pass a No. 20 (850-μm) sieve. Further divide the sample to obtain a portion of approximately 200 g and crush to pass a No. 60 (250-μm) sieve. Divide again to obtain approximately 50 g and pulverize this fraction such that 95 % or more passes a No. 200 (75-μm) sieve. This is the analysis sample which is dried to constant weight at 110 ± 5°C.

NOTE 1—If the laboratory sample appears to be wet it must be air-dried prior to crushing to avoid caking.

NOTE 2—Recommended practice for collecting samples and the equipment and procedures for crushing and dividing are described in Methods D 346 and D 2013.

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[1] This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.05 on Properties of Fuels, Petroleum Coke, and Oil Shale.

Current edition approved Oct 26, 1984. Published February 1985.

[2] *Annual Book of ASTM Standards*, Vol 05.05.

8. Preparation of Apparatus

8.1 The muffle furnace, when initially set up, must be tested for adequate air circulation. The air flow is adequate if replicate samples do not produce a lower ash at higher air flow rates with the same furnace loading. Maintain air flow at the same level for subsequent analyses to ensure consistency in analytical technique.

9. Procedure

9.1 Weigh into a coded, preignited crucible, 10 ± 0.1 mg of the dried analysis sample.

9.2 Place the crucible into a cold muffle furnace that has been tested for adequate air circulation, and heat directly to above 700°C until constant mass (±0.2 mg) is obtained. Do not exceed 750°C.

9.3 Allow the furnace to cool to 150°C and transfer the crucible to the desiccator for further cooling.

9.4 Weigh the crucible and ash to the nearest 0.1 mg.

10. Calculation

10.1 Calculate the ash percent in the analysis sample as follows:

$$\text{Ash \%} = \frac{A - B}{C} \times 100$$

where:

A = mass of crucible and ash residue, g,
B = mass of empty crucible, g, and
C = mass of analysis sample, g.

11. Report

11.1 Report the ash content mass percent to the third decimal (thousandth of a percent) when the average of replicate values permits.

11.2 Report the ash content mass percent to the second decimal (hundredth of a percent) when only single values are determined.

12. Precision and Bias[3]

12.1 *Precision*—The precision of this test method as determined by the statistical examination of the interlaboratory test results is as follows:

12.1.1 *Repeatability*—The difference between successive results obtained by the same operator with the same apparatus under constant operating conditions on identical test materials would, in the long run, in the normal and correct operation of the test method exceed the following values only in one case in twenty.

Repeatability = 0.02

12.1.2 *Reproducibility*—The difference between two single and independent results obtained by different operators working in different laboratories on identical material would in the long run, exceed the following values only in one case in twenty.

Reproducibility = 0.06

NOTE 3—The values in the statements were determined in a cooperative program following RR:D02-1007.

12.2 *Bias*—Bias depends on conformance to the empirical conditions of the test. The ash content should not be understood to be the same as the mineral content of the petroleum coke.

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[3] Supporting data have been filed at ASTM Headquarters and may be obtained by requesting RR: D02-1190.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should

APPENDIX

Designation: A 812/A 812M – 83^ε

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia, Pa. 19103
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If not listed in the current combined index, will appear in the next edition.

Standard Specification for
STEEL SHEET, HIGH-STRENGTH, LOW-ALLOY, HOT-ROLLED, FOR WELDED LAYERED PRESSURE VESSELS[1]

This standard is issued under the fixed designation A 812/A 812M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε Note—The title was changed editorially in August 1984.

1. Scope

1.1 This specification covers hot-rolled, high-strength, low-alloy steel sheet intended primarily for use in coil form in the construction of welded layered pressure vessels.

1.2 The following grades are included in this specification:

Mechanical Requirements

Grade	Yield Strength, min		Tensile Strength, min	
	ksi	MPa	ksi	MPa
65	65	450	85	585
80	80	550	100	690

1.3 This material is produced in coil form. However, testing is to represent the back end and the middle of the slab as rolled—see 6.1.4. The purchaser should therefore recognize this requires cutting the as-rolled coil to obtain test samples and results in half-size coils.

1.4 The values stated in either inch-pound units or SI (metric) units are to be regarded separately as standard. Within the text the SI units are shown in brackets. The values stated in each system are not exact equivalents, therefore each system must be used independently of the other. Combining values of the two systems may result in nonconformance with the specification.

2. Referenced Documents

2.1 *ASTM Standards:*

A 568 Specification for Steel, Sheet, Carbon and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for[2]

A 568M Specification for Steel, Sheet, Carbon and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for [Metric][2]

3. General Requirements for Delivery

3.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specifications A 568 or A 568M unless otherwise provided herein.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information, as required, to describe the material adequately:

4.1.1 Specification number, grade, and date of issue,

4.1.2 Name of material (hot-rolled sheet),

4.1.3 Special requirements, if required, and

4.1.4 Dimensions, including type of edges.

NOTE 1—A typical ordering description is as follows: ASTM Axxx, Grade 65, Hot-Rolled Sheet, 0.157 in. [4.00 mm] by 48 in. [1220 mm] by coil, cut edges.

5. Chemical Requirements

5.1 *Cast or Heat Analysis*—The analysis of the steel shall conform to the requirements in Table 1.

6. Mechanical Requirements

6.1 *Tensile Strength*

6.1.1 *Requirements*—The material as represented by the tension test specimens shall conform to the tensile properties prescribed in Table 2.

---

[1] This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.19 on Sheet Steel and Strip.

Current edition approved May 27, 1983. Published December 1983.

[2] *Annual Book of ASTM Standards*, Vol 01.03.

6.1.2 *Number of Tests*—Two tension tests shall be made from the product of each slab as rolled.

6.1.3 *Test Specimen Condition and Size*—Test specimens shall be prepared for testing from coils in their finished condition and shall be the full thickness of the sheet.

6.1.4 *Test Specimen Location and Orientation*—Tension test specimens shall be taken at points representing the back end and the middle of the slab as rolled. These specimens shall be located approximately midway between the center and edge of the coil and shall be transverse to the longitudinal axis.

7. Finish and Appearance

7.1 *Surface Finish*:

7.1.1 Unless otherwise specified, the material shall be furnished without removing the hot-rolled oxide or scale.

7.2 *Edges*—Unless otherwise specified, mill edges shall be furnished.

8. Marking

8.1 The name or the brand of the manufacturer, heat number, slab or coil number, specification number and year of issue, and grade shall be legibly and durably marked on each finished coil. Steel-die marking of coils is prohibited.

9. Certifications and Reports

9.1 The manufacturer shall furnish copies of a test report showing the results of the cast or heat analysis and mechanical property tests made to determine compliance with this specification. The report shall include the purchase order number, specification designation, and test identification number correlating the test results with material represented.

TABLE 1 Chemical Requirements

Element	Composition, %	
	Grade 65, Heat or Cast	Grade 80, Heat or Cast
Carbon, max	0.23	0.23
Manganese, max	1.40	1.50
Phosphorus, max	0.035	0.035
Sulfur, max	0.040	0.040
Silicon	A	0.15–0.50
Columbium plus vanadium	0.02–0.15B	0.02–0.15B
Chromium, max	. . .	C

A Killed steel may be supplied when specified. When silicon-killed steel is ordered, a range from 0.15 to 0.50 % shall be supplied.

B Columbium content not to exceed 0.05 % on heat analysis, 0.06 % on product analysis.

C Chromium may be present as an additional element but shall not exceed 0.35 %.

TABLE 2 Tensile Requirements

	Grade 65	Grade 80
Tensile strength:		
ksi	85–110	100–125
MPa	585–760	690–860
Yield strength, min:A		
ksi	65	80
MPa	450	550
Elongation in 2 in. [50 mm], min, %:		
Under 0.230 to 0.145 in. [under 6.0 to 3.8 mm], incl. in thickness	15	13
Under 0.145 to 0.089 in. [under 3.8 to 2.2 mm], incl. in thickness	14	12
Under 0.089 to 0.057 in. [under 2.2 to 1.4 mm], incl. in thickness	13	11
Elongation in 8 in. [200 mm], min, %:		
Under 0.230 to 0.145 in. [under 6.0 to 3.8 mm], incl. in thickness	9	7

A Yield strength determined by the 0.2 % offset or 0.5 % extension under load methods.

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, Pa. 19103.

APPENDIX

Designation: B 632 – 86

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia, Pa. 19103
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If not listed in the current combined index, will appear in the next edition.

Standard Specification for
ALUMINUM-ALLOY ROLLED TREAD PLATE[1]

This standard is issued under the fixed designation B 632; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This specification has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards.

1. Scope

1.1 This specification covers aluminum-alloy rolled flat tread plate, mill-finish, with a raised pattern on one side, in the alloy, tempers, and thicknesses shown in Tables 1 and 2.

1.2 Alloy and temper designation are in accordance with ANSI H35.1. The equivalent Unified Numbering System alloy designation is that of Table 1 preceded by A9, which is A96061 for alloy 6061 in accordance with Practice E 527.

NOTE 1—A complete metric companion to Specification B 632 has been developed—B 632M; therefore, no metric equivalents are presented in this specification.

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of material purchaser form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*

B 557 Methods of Tension Testing of Wrought and Cast Aluminum- and Magnesium-Alloy Products[2]

B 597 Practice for Heat Treatment of Aluminum Alloys[2]

B 666 Practice for Identification Marking of Aluminum Products[2]

E 29 Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values[3]

E 34 Methods for Chemical Analysis of Aluminum and Aluminum Alloys[4]

E 55 Methods for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition[4]

E 101 Method for Spectrographic Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique[5]

E 227 Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique[5]

E 290 Method for Semi-Guided Bend Test for Ductility of Metallic Materials[6]

E 527 Practice for Numbering Metals and Alloys[7] (UNS)

E 607 Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere[5]

E 716 Practices for Sampling of Aluminum and Its Alloys for Spectrochemical Analysis[5]

2.3 *American National Standards:*

ANSI H35.1 Alloy and Temper Designation Systems for Aluminum[8]

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products[8]

2.4 *Military Standards:*

MIL-STD-129 Marking for Shipment and Storage[9]

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[1] This specification is under the jurisdiction of ASTM Committee B-7 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.03 on Aluminum Alloy Wrought Products.

Current edition approved Jan. 31, 1986. Published March 1986. Originally published as B 632 – 78. Last previous edition B 632 – 84.

[2] *Annual Book of ASTM Standards*, Vol 02.02.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] *Annual Book of ASTM Standards*, Vol 03.05.

[5] *Annual Book of ASTM Standards*, Vol 03.06.

[6] *Annual Book of ASTM Standards*, Vol 03.01.

[7] *Annual Book of ASTM Standards*, Vol 01.04.

[8] Available from American National Standards Institute, 1430 Broadway, New York, NY 10018.

[9] Available from Naval Publications and Forms Center, 5801 Tabor Ave., Philadelphia, PA 19120.

MIL-STD-649 Preparation for Storage and Shipment of Aluminum and Magnesium Products[9]

MIL-H-6088 Heat Treatment of Alloys[9]

2.5 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[9]

3. Terminology

3.1 *Definitions:*

3.1.1 *mill finish*—a nonuniform finish which may vary from piece to piece and within a piece, and which may not be entirely free of stains or oil.

3.1.2 *producer*—the primary manufacturer of the material.

3.1.3 *supplier*—the category of jobbers and distributors only as distinct from producers.

3.1.4 *tread plate*—sheet and plate having a specified raised pattern on one side. The specified thickness does not include the pattern height.

3.2 *Description of Term Specific to This Standard:*

3.2.1 *capable of*—The term "capable of" as used in this specification means that the tests need not be performed. However, should testing by the purchaser establish that the material does not meet these requirements, the material shall be subject to rejection.

4. Ordering Information

4.1 Orders for material under this specification shall include the following:

4.1.1 This specification number,

4.1.2 Quantity in pieces or pounds,

4.1.3 Alloy (7.1),

4.1.4 Temper (9.1),

4.1.5 Dimensions (thickness, width, and length),

4.1.6 Whether heat treatment in accordance with Practice B 597 is required (8.2),

4.1.7 Whether tension test specimens that retain the pattern are unacceptable (Table 2, footnote C),

4.1.8 Whether bend tests are required (10.1),

4.1.9 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (13.1),

4.1.10 Whether certification of the material by the producer or supplier is required (17.1),

4.1.11 Whether marking is required (15.1), and

4.1.12 Whether MIL-STD-649 applies and, if so, the levels of preservation, packaging, and packing required (16.3).

5. Responsibility for Quality Assurance

5.1 *Responsibility for Inspection and Tests*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser in the order or at the time of contract signing. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to assure that material conforms to prescribed requirements.

5.2 *Lot Definition*—An inspection lot shall be defined as follows:

5.2.1 For heat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper, and thickness traceable to a heat-treat lot or lots, and subjected to inspection at one time.

5.2.2 For nonheat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper, and thickness subjected to inspection at one time.

6. General Quality

6.1 Unless otherwise specified, all tread plate shall be supplied in the mill finish and shall be uniform as defined by the requirements of this specification and shall be commercially sound. Any requirement not so covered is subject to negotiation between the producer and the purchaser.

6.2 Each piece shall be examined to determine conformance to this specification with respect to general quality and identification marking. On approval of the purchaser, however, a system of statistical quality control may be used for such examinations.

7. Chemical Composition

7.1 *Limits*—The tread plate shall conform to the chemical composition limits specified in Table 1. Conformance shall be determined by analyzing samples taken at the time the ingots are poured, or samples taken from the finished or semifinished product. If the chemical composition of the material has been determined during the course of manufacture, sampling and analysis of the finished product shall not be necessary.

NOTE 2—It is standard practice in the United States aluminum industry to determine conformance to the chemical composition limits prior to further processing of ingots into wrought products. Due to the continuous nature of the process, it is not practical to keep a specific ingot analysis identified with a specific quantity of finished material.

7.2 *Number of Samples*—The number of samples taken for the determination of chemical composition shall be as follows:

7.2.1 When samples are taken at the time the ingots are poured, at least one sample shall be taken for each group of ingots poured simultaneously from the same source of molten metal.

7.2.2 When samples are taken from the finished or semifinished product, a sample shall be taken to represent each 4000 lb or fraction thereof, of material in the lot, except that not more than one sample shall be required per piece.

7.3 *Methods of Sampling*—Samples for determination of chemical composition shall be taken in accordance with one of the following methods:

7.3.1 Samples for chemical analysis shall be taken by drilling, sawing, milling, turning, or clipping a representative piece or pieces to obtain a prepared sample of not less than 75 g. Sampling shall be in accordance with Method E 55.

7.3.2 Sampling for spectrochemical analysis shall be in accordance with Practice E 716. Samples for other methods of analysis shall be suitable for the form of material being analyzed and the type of analytical method used.

7.4 *Methods of Analysis*—The determination of chemical composition shall be made in accordance with suitable chemical (Methods E 34), spectrochemical (Methods E 101, E 227, or E 607), or other methods. In case of dispute, the method of analysis shall be agreed upon by the producer and purchaser.

8. Heat Treatment

8.1 Unless specified in 8.2, producer or supplier heat treatment for the applicable tempers in Table 2 shall be in accordance with MIL-H-6088.

8.2 When specified, heat treatment of applicable tempers in Table 2 shall be in accordance with Practice B 597.

9. Tensile Properties of Materials as Supplied

9.1 *Limits*—The tread plate shall conform to the tensile properties specified in Table 2.

9.2 *Number of Specimens*—One specimen shall be taken from a randomly selected piece representing the following quantities of tread plate in a lot:

Thickness	Quantity
0.100–0.249 in.	2000 lb or less
over 0.249–0.625 in.	4000 lb or less

Other procedures for selecting samples may be employed if approved by the purchaser.

9.3 *Test Specimens*—Geometry of test specimens and the location in the product from which they are taken shall be as specified in Methods B 557.

9.4 *Test Methods*—The tension test shall be made in accordance with Methods B 557.

10. Bend Properties

10.1 *Limits*—Tread plate shall be capable of being bent cold through an angle of 180° around a pin having a diameter equal to *N* times the thickness of the sheet or plate without cracking, the value of *N* being as prescribed in Table 3 for the specified tempers and thicknesses. The test need not be conducted unless specified on the purchase order.

10.2 *Number of Specimens*—The number of specimens from each lot of O temper material and F temper material to be tested shall be as specified in 9.2.

10.3 *Test Specimens*—When bend tests are made, the specimens shall be the full thickness of the material, approximately ¾ in. in width, and when practical, at least 6 in. in length. Such specimens may be taken in any direction and their edges may be rounded to a radius of approximately 1/16 in. if desired. The pattern side of the product shall be on the outside of the bend.

10.4 *Test Methods*—The bend tests shall be made in accordance with Method E 290 except as stated otherwise in 10.3.

11. Producer Confirmation of Heat-Treat Response

11.1 In addition to the requirements of 9.1 and 10.1, mill-produced material in the O or F temper (without the subsequent imposition of cold work or forming operations) shall be capable, upon proper solution heat treatment and natural aging at room temperature, of developing the properties specified in Tables 2 and 3 for T42 temper material. The natural aging period at room temperature shall be not less than 4 days, but samples of material may be tested prior to 4 days aging, and if the material fails to conform to the requirements of T42 temper material, the tests may be repeated without prejudice after completion of 4 days aging.

11.2 Material in the T4 and T42 tempers shall, after proper precipitation heat treatment, be capable of attaining the properties specified in Tables 2 and 3 for the T6 and T62 tempers respectively.

11.3 *Number of Specimens*—The number of specimens from each lot of O temper material and F temper material to be tested to verify conformance with 11.1 and 11.2 shall be as specified in 9.2.

12. Tolerances

12.1 *Weight*—The allowable deviation from nominal weight as shown in Table 4 shall not exceed 8 %. The minimum weight is controlled by thickness tolerance and minimum pattern height.

12.2 *Pattern Height*—The minimum height of the raised pattern figures is 0.040 in. (The pattern figure height is the difference in thickness between the maximum thickness reading to the top of the figure and the thickness of an adjacent nonfigured area.) The top of the raised figure may be rounded with sloping sides. A definite line of demarcation between the figure top and sides is not required. The pattern shall conform to Fig. 1.

12.3 *Width, Length, Pattern Line Camber, Lateral Bow, and Squareness*—Tread plate shall not vary in width, length, pattern line camber, lateral bow, or squareness by more than the permissible variations prescribed in the following tables of ANSI H35.2:

Table No.	Title
7.2	Width
7.3	Length
7.6	Camber of Pattern Line
7.7	Lateral Bow
7.8	Squareness

12.4 *Thickness*—The thickness shall be that permitted by the respective tolerances shown in Table 5.

12.5 *Sampling for Inspection*—Examination for dimensional conformance shall be made to ensure conformance to the tolerance specified. On approval of the purchaser, a system of statistical quality control for such sampling and examinations may be used.

13. Source Inspection

13.1 If the purchaser desires that his representative inspect or witness the inspection and testing of the material prior to shipment, such agreement shall be made by the purchaser and producer as part of the purchase contract.

13.2 When such inspection or witness of inspection and testing is agreed upon, the purchaser's representative shall be afforded all reasonable facilities to satisfy him that the material meets the requirements of this specification. Inspection and tests shall be conducted so there is no unnecessary interference with the producer's operations.

14. Retest and Rejection

14.1 If any material fails to conform to all of the applicable requirements of this specification, it shall be cause for rejection of the inspection lot.

14.2 When there is evidence that a failed specimen was not representative of the inspection lot and when no other sampling plan is provided or approved by the purchaser through the contract or purchase order, at least two additional specimens shall be selected to replace each test specimen that failed. All specimens so selected for retest shall meet the requirements of the specification or the lot shall be subject to rejection.

14.3 Material in which defects are discovered subsequent to inspection may be rejected.

14.4 If material is rejected by the purchaser, the producer or supplier is responsible only for replacement of the material to the purchaser. As much as possible of the rejected material shall be returned to the producer or supplier by the purchaser.

15. Identification Marking of Product

15.1 Identification marking of this product is normally not required. When marking is necessary and when specified on the purchase order or contract, all sheet and plate shall be marked on the back side in accordance with Practice B 666 or by identifying each sheet or plate near one end on the back side with the producer's name or trademark, alloy, temper, thickness, and this specification number.

16. Packaging and Package Marking

16.1 The material shall be packaged to provide adequate protection during normal handling and transportation and each package shall contain only one size, alloy and temper of material unless otherwise agreed. The type of packaging and gross weight of containers shall, unless other-

APPENDIX

wise agreed upon, be at the producer's or supplier's discretion, provided that they are such as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the delivery point.

16.2 Each shipping container shall be marked with the purchase order number, material size, specification number, alloy and temper, gross and net weights, and the producer's name or trademark.

16.3 When specified in the contract or purchase order, material shall be preserved, packaged, and packed in accordance with the requirements of MIL-STD-649. The applicable levels shall be as specified in the contract or order. Marking for shipment of such material shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

17. Certification

17.1 The producer or supplier shall, on request, furnish to the purchaser a certificate stating that each lot has been sampled, tested, and inspected in accordance with this specification, and has met the requirements.

TABLE 1 Chemical Composition Limits[A,B,C] for Alloy 6061

Silicon	0.40–0.8	Zinc	0.25
Iron	0.7	Titanium	0.15
Copper	0.15–0.40	Others—each	0.05
Manganese	0.15	Others—total[D]	0.15
Magnesium	0.8–1.2	Aluminum	remainder
Chromium	0.04–0.35		

[A] Limits are in weight percent maximum unless shown as a range or stated otherwise.

[B] Analysis shall regularly be made only for the elements specified in this table. If however, the presence of other elements is suspected or indicated in amounts greater than the specified limits, further analysis shall be made to determine that these elements are not present in excess of the specified limits.

[C] For purposes of determining conformance to these limits, an observed value or a calculated value attained from analysis shall be rounded to the nearest unit in the last righthand place of figures used in expressing the specified limit, in accordance with the rounding-off method of Recommended Practice E 29.

[D] Other Elements—Total shall be the sum of unspecified metallic elements 0.010 % or more, rounded to the second decimal before determining the sum.

TABLE 2 Tensile Properties[A,B]

Alloy and Temper	Specified Thickness[C], in.	Tensile Strength, ksi		Yield Strength (0.2 % Offset), ksi		Elongation in 2 in. or 4D[D], min, %
		min	max	min	max	
6061-O	0.100–0.128		22.0		12.0	16
	0.129–0.499		22.0		12.0	18
	0.500–0.625		22.0			18
6061-T4	0.100–0.249	30.0	...	16.0		14
	0.250–0.625	30.0	...	16.0		16
6061-T42[E]	0.100–0.249	30.0	...	14.0		14
	0.250–0.625	30.0	...	14.0		16
6061-T6 and T62[E]	0.100–0.188	42.0	...	35.0		8
	0.189–0.249	42.0	...	35.0		8
	0.250–0.499	42.0	...	35.0		10
	0.500–0.625	42.0	...	35.0		9
6061-F	0.100–0.625			no requirements		

[A] To determine conformance to this specification, each value for tensile strength and for yield strength shall be rounded to the nearest 0.1 ksi and each value for elongation to the nearest 0.5 %, both in accordance with the rounding-off method of Recommended Practice E 29.

[B] See Appendix X1.

[C] For sheet and plate under ½ in. in thickness, the standard ½ in. wide tension test specimen shall be used. Unless otherwise specified, rectangular tension test specimens may be tested without the removal of the raised pattern.

[D] The specimen diameter is represented by D.

[E] This temper is not available from the material producer.

TABLE 3 Bend Diameter Factors[A]

Thickness, in.	Factor, N		
	Temper O	Tempers T4, T42	Tempers T6, T62
0.100	2	4	7
0.125	2	4	7
0.156	2	4	7
0.188	2	4	7
0.250	4	5	8
0.375	4	6	8
0.500	4	6	8
0.625	4	6	8

[A] See 8.1.2.

TABLE 4 Weights Per Square Foot

NOTE—The following nominal weights per square foot are based on a density of 0.098 lb/in.^{3} which is the value for alloy 6061.

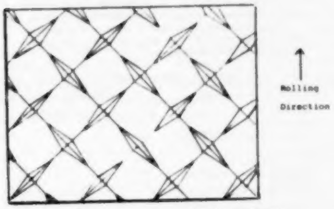
Thickness, in.	Nominal Weight, lb/ft^2
0.100	1.55
0.125	1.90
0.156	2.34
0.188	2.79
0.250	3.67
0.375	5.43
0.500	7.20
0.625	8.96

TABLE 5 Thickness Tolerances for Tread Plate

Specified Thickness,[A] in.	Tolerance, in.	
	Plus[B]	Minus
0.100	0.008	0.0012
0.125	0.010	0.015
0.156	0.011	0.019
0.188	0.013	0.023
0.250	0.018	0.030
0.375	0.025	0.045
0.500	0.035	0.060
0.625	0.044	0.075

[A] Specified thickness does not include height of pattern.

[B] In case of dispute, allowed plus tolerance shall be determined by weight.



NOTE—Length of diamond: $1\frac{9}{16}$ in. maximum. Width of diamond: $\frac{11}{32}$ in. maximum.

FIG. 1 Pattern Orientation of Raised Figures (Previously Known as Pattern B)

APPENDIX

(Nonmandatory Information)

X1. BASIS FOR ESTABLISHMENT OF MECHANICAL PROPERTY LIMITS

X1.1 Standard mechanical property limits for the respective size ranges are based on an analysis of data from standard production material and are established at a level at which at least 99 % of the population of the values obtained from all standard material in the size range meets the established value (refer to the paper "Statistical Aspects of Mechanical Property Assurance") in the Related Material Section of the *Annual Book of ASTM Standards*, Vol 02.02.

X2. PRINCIPLE CHANGES IN THIS ISSUE

X2.1 The following principle changes in this revision are recorded for the convenience of the user.

X2.1.1 Reinstatement of MIL-H-6088 as heat treatment practice in Section 8.

X2.1.2 The workmanship statement of Section 6 has been revised.

X2.1.3 Provision for tension testing rectangular specimens without removal of pattern has been added in Table 2, footnote C.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, Pa. 19103.

APPENDIX

Designation: D 388 – 84

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Classification of
COALS BY RANK[1]

This standard is issued under the fixed designation D 388; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This standard covers the classification of coals by rank, that is, according to their degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite.

NOTE 1—This classification is applicable to coals that are composed mainly of vitrinite. Coals rich in inertinite or liptinite (exinite) do not fit into the classification because the properties that determine rank (calorific value, volatile matter, and agglomerating propensity) differ greatly from those of vitrinite. Such coals may be recognized by megascopic examination. (See Definitions D2796 for definitions of the terms used.) They contain only a small amount of vitrain and commonly consist mainly of dull attrital materials. In North America, these coals are principally nonbanded varieties.

The precision of the classification of impure coal may be impaired by the effect of large amounts of mineral matter on the determination of volatile matter and calorific value, and on their calculation to the mineral-matter-free basis.

2. Referenced Documents

2.1 *ASTM Standards:*

D1412 Test Method for Equilibrium Moisture of Coal at 96 to 97 Percent Relative Humidity and 30°C[2]

D1756 Test Method for Carbon Dioxide in Coal[2]

D1757 Test Methods for Sulfur in Ash from Coal and Coke[2]

D2013 Method of Preparing Coal Samples for Analysis[2]

D2015 Test Method for Gross Calorific Value of Solid Fuel by the Adiabatic Bomb Calorimeter[2]

D2234 Method for Collection of a Gross Sample of Coal[2]

D2796 Definitions of Terms Relating to Megascopic Description of Coal and Coal Seams and Microscopical Description and Analysis of Coal[2]

D3173 Test Method for Moisture in the Analysis Sample of Coal and Coke[2]

D3174 Test Method for Ash in the Analysis Sample of Coal and Coke[2]

D3175 Test Method for Volatile Matter in the Analysis Sample of Coal and Coke[2]

D3177 Test Methods for Total Sulfur in the Analysis Sample of Coal and Coke[2]

D3180 Methods for Calculating Coal and Coke Analyses from As-Determined to Different Bases[2]

D3286 Test Method for Gross Calorific Value of Solid Fuel by the Isothermal-Jacket Bomb Calorimeter[2]

3. Significance and Use

3.1 This classification establishes categories of coal based on gradational properties that depend principally on the degree of metamorphism to which the coal was subjected while buried. These categories indicate ranges of physical and chemical characteristics that are useful in making broad estimates of the behavior of coal in mining, preparation, and use.

4. Basis of Classification

4.1 Classification is according to fixed carbon and calorific value (expressed in Btu/lb) calculated to the mineral-matter-free basis. The higher-rank coals are classified according to fixed carbon on the dry basis; the lower-rank coals are classified according to calorific value on the moist basis. Agglomerating character is used to differentiate between certain adjacent groups. (See Appendix for published analyses suitable for coal classification.)

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[1] This classification is under the jurisdiction of ASTM Committee D-5 on Coal and Coke and is the direct responsibility of Subcommittee D05.18 on Classification of Coals.

Current edition approved Sept. 28, 1984. Published November 1984. Originally published as D 388 – 34 T. Last previous edition D 388 – 82.

[2] *Annual Book of ASTM Standards*, Vol 05.05.

APPENDIX

5. Classification by Rank

5.1 *Fixed Carbon and Calorific Value*—Coals shall be classified by rank in accordance with Table 1. Classify coals having calorific values of 14 000 Btu/lb or more on the moist, mineral-matter-free basis, and coals having fixed carbon of 69 % or more on the dry, mineral-matter-free basis, according to fixed carbon on the dry, mineral-matter-free basis; classify coals having calorific values less than 14 000 Btu/lb on the moist, mineral-matter-free basis according to calorific value on the moist, mineral-matter-free basis, provided the fixed carbon on the dry, mineral-matter-free basis is less than 69 %.

5.2 *Agglomerating Character*—Classify coals having 86 % or more fixed carbon on the dry, mineral-matter-free basis, if agglomerating, in the low volatile group of the bituminous class. Classify coals having calorific values in the range from 10 500 to 11 500 Btu/lb on the moist, mineral-matter-free basis according to their agglomerating character (Table 1).

6. Symbols for Expressing Classification

6.1 Express the position of a coal in the scale of rank in condensed form as, for example (62 - 146), in which the parentheses signify that the contained numbers are on the mineral-matter-free basis. The first number represents fixed carbon on the dry basis, reported to the nearest whole percent. The second number represents calorific value on the moist basis, expressed as hundreds of Btu/lb to the nearest hundred; for example, 14 580 Btu/lb would be represented as 146.

6.2 Where it is desired to abbreviate the designation of the ranks of coal by group, the following abbreviations shall be used:

ma—meta-anthracite
an—anthracite
sa—semianthracite
lvb—low volatile bituminous
mvb—medium volatile bituminous
hvAb—high volatile *A* bituminous
hvBb—high volatile *B* bituminous
hvCb—high volatile *C* bituminous
subA—subbituminous *A*
subB—subbituminous *B*
subC—subbituminous *C*
ligA—lignite *A*
ligB—lignite *B*

7. Sampling

7.1 *Bed Samples*—Classify a coal bed, or part of a coal bed, in any locality based on the average analysis and calorific value (and agglomerating character where required) of not less than three and preferably five or more face samples taken in different and uniformly distributed localities, either within the same mine or closely adjacent mines representing a continuous and compact area not greater than approximately four square miles in regions of geological uniformity. In regions where conditions indicate that the coal probably varies rapidly in short distances, the spacing of sampling points and grouping of analyses to provide average values shall not be such that coals of obviously different rank will be used in calculating average values.

7.1.1 Take samples in accordance with the U. S. Bureau of Mines method[1] or its equivalent and place in moisture-tight containers in the mine.

7.1.2 Analyses of samples from outcrops or from weathered or oxidized coal shall not be used for classification by rank.

7.1.3 In case the coal is likely to be classified on the "moist" basis, that is, inclusive of its natural complement of inherent or bed moisture, take samples in a manner most likely to preserve inherent moisture for purposes of analysis. Samples of low-rank coals which appear dry at the time of collection frequently give off moisture which condenses on the inner surface of the sample containers before they are opened for analysis. In the case of coals which were free from visible surface moisture when sampled, but which show moisture on the inner surface of the containers when opened, weigh both the container and the coal before and after air-drying, and report the total loss in weight as air-drying loss.

7.1.4 If it is impossible to sample the coal without including visible surface moisture, or if there may be other reasons to question the accuracy of inherent moisture content determinable from the sample, and the coal is likely to be classified on the "moist" basis, the sampler shall include the following statement in the description: "Moisture questionable." Samples so marked shall not be used for classification on a moist basis unless brought to a standard condition of moisture equilibrium at 30°C in a vacuum desiccator containing a saturated solution of potassium sulfate (97 % humidity) as specified in Test Method D 1412. Analyses of such samples that have been treated in this manner shall be designated as "samples equilibrated at 30°C and 97 % humidity."

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[1] Holmes, J. A., "The Sampling of Coal in the Mine," U. S. Bureau of Mines, *Technical Paper No. 1*, 1911. A version is included in J. M. Schopf, "Field Description and Sampling of Coal Beds," U. S. Geological Survey *Bulletin No. 1111-B*, 1960.

7.2 *Tipple or Shipment Samples*—The apparent rank of "run of mine" coal and prepared sizes of coal shall be based on representative samples taken in accordance with Section 7 of Method D 2234.

7.2.1 In case the coal is likely to be classified on the "moist" basis, take samples at the tipple or preparation plant and protect against loss of moisture as specified in 10.2 of Method D 2234. Take samples that appear dry at the time of collection in accordance with 7.1.3 to ensure correct determination of total air-drying loss. Mark samples that have visible surface moisture on the coal when sampled, and that are likely to be classified on the "moist" basis, in accordance with 7.1.4.

7.2.2 A standard rank determination cannot be made unless samples have been obtained in accordance with Section 7. However, the relation to standard determinations may be usefully given for tipple or shipment samples, or for specimens or other samples taken under unspecified conditions, providing the same standards of analysis and computation are followed. Designate these comparative indications as "apparent rank." They indicate the correct relative position for the coal sample analyzed but do not imply any standards of bed sampling. Whenever apparent rank is stated, give additional information as to the nature of the sample.

8. Methods of Analysis and Testing

8.1 *Laboratory Sampling and Analysis*—Prepare coal in accordance with Method D 2013 and analyze it in accordance with Test Methods D 3173, D 3174, D 3175, and D 3177. Determine its calorific value in accordance with either Test Method D 2015 or D 3286.

8.2 *Agglomerating Character*—The test carried out by the examination of the residue in the platinum crucible incident to the volatile matter determination shall be used.[4] Coals which, in the volatile matter determination, produce either an agglomerate button that will support a 500-g weight without pulverizing, or a button showing swelling or cell structure, shall be considered agglomerating from the standpoint of classification.

9. Calculation to Mineral-Matter-Free Basis

9.1 *Calculation of Fixed Carbon and Calorific Value*—For classification of coal, according to rank, fixed carbon and calorific value shall be calculated to the mineral-matter-free basis in accordance with either the Parr formulas,[5] Eqs 1, 2, and 3, or the approximation formulas, Eqs 4, 5, and 6, that follow. In case of litigation, use the appropriate Parr formula.

9.2 Calculation to Mm-free basis:

Parr Formulas:

$$\text{Dry, Mm-free FC} = (\text{FC} - 0.15\text{S})/[100 - (\text{M} + 1.08\,\text{A} + 0.55\text{S})] \times 100 \quad (1)$$

$$\text{Dry, Mm-free VM} = 100 - \text{Dry, Mm-free FC} \quad (2)$$

$$\text{Moist, Mm-free Btu} = (\text{Btu} - 50\text{S})/[100 - (1.08\text{A} + 0.55\text{S})] \times 100 \quad (3)$$

NOTE 2—The above formula for fixed carbon is derived from the Parr formula for volatile matter.

Approximation Formulas:

$$\text{Dry, Mm-free FC} = \text{FC}/[100 - (\text{M} + 1.1\text{A} + 0.1\text{S})] \times 100 \quad (4)$$

$$\text{Dry, Mm-free VM} = 100 - \text{Dry, Mm-free FC} \quad (5)$$

$$\text{Moist, Mm-free Btu} = \text{Btu}/[100 - (1.1\text{A} + 0.1\text{S})] \times 100 \quad (6)$$

where:

Mm = mineral matter,
Btu = British thermal units per pound (calorific value),
FC = percentage of fixed carbon,
VM = percentage of volatile matter,
M = percentage of moisture,
A = percentage of ash, and
S = percentage of sulfur.

Above quantities are all on the inherent moisture basis. This basis refers to coal containing its natural inherent or bed moisture, but not including water adhering to the surface of the coal. See Methods D 3180, 5.1.3, for calculating analyses to this basis.

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[4] Gilmore, R. E., Connell, G. P., and Nicholls, J. H. H., "Agglomerating and Agglutinating Tests for Classifying Weakly Caking Coals," *Transactions*, Am. Institute of Mining and Metallurgical Engineers, Coal Division, Vol 108, 1934, p. 255.

[5] Parr, S. W., "The Classification of Coal," *Bulletin No. 180*, Engineering Experiment Station, University of Ill., 1928.

9.3 *Modification for Coals High in Carbonate*—In case of controversy, coal samples containing more than 1.0 % carbon dioxide occurring as carbonates determined in accordance with Test Method D 1756 shall be processed in accordance with Test Method D 3174–73, Section 5.1, Note 2 (*a*), or the ash shall be corrected for retained sulfur as determined in accordance with Test Methods D 1757.

TABLE 1 Classification of Coals by Rank[A]

Class	Group	Fixed Carbon Limits, percent (Dry, Mineral-Matter-Free Basis)		Volatile Matter Limits, percent (Dry, Mineral-Matter-Free Basis)		Calorific Value Limits, Btu per pound (Moist,[B] Mineral-Matter-Free Basis)		Agglomerating Character
		Equal or Greater Than	Less Than	Greater Than	Equal or Less Than	Equal or Greater Than	Less Than	
I. Anthracitic	1. Meta-anthracite	98	...	...	2	...	...	nonagglomerating
	2. Anthracite	92	98	2	8	...	...	
	3. Semianthracite[C]	86	92	8	14	...	...	
II. Bituminous	1. Low volatile bituminous coal	78	86	14	22	...	...	commonly agglomerating[E]
	2. Medium volatile bituminous coal	69	78	22	31	...	...	
	3. High volatile *A* bituminous coal	...	69	31	...	14 000[D]	...	
	4. High volatile *B* bituminous coal	...	...	...	...	13 000[D]	14 000	
	5. High volatile *C* bituminous coal	...	...	...	...	11 500 10 500	13 000 11 500	agglomerating
III. Subbituminous	1. Subbituminous *A* coal	...	...	...	...	10 500	11 500	nonagglomerating
	2. Subbituminous *B* coal	...	...	...	...	9 500	10 500	
	3. Subbituminous *C* coal	...	...	...	...	8 300	9 500	
IV. Lignitic	1. Lignite *A*	...	...	...	...	6 300	8 300	
	2. Lignite *B*	...	...	...	...	...	6 300	

[A] This classification does not apply to certain coals, as discussed in Note 1.

[B] Moist refers to coal containing its natural inherent moisture but not including visible water on the surface of the coal.

[C] If agglomerating, classify in low-volatile group of the bituminous class.

[D] Coals having 69 % or more fixed carbon on the dry, mineral-matter-free basis shall be classified according to fixed carbon, regardless of calorific value.

[E] It is recognized that there may be nonagglomerating varieties in these groups of the bituminous class, and that there are notable exceptions in high volatile *C* bituminous group.

APPENDIX

(Nonmandatory Information)

X1. PUBLISHED ANALYSES SUITABLE FOR COAL CLASSIFICATION

X1.1 Only such published analyses as have been made in accordance with standard ASTM methods shall be used in the classification of coal, and if classification is on the basis of moist calorific value, then only those samples which have been taken and transported to the laboratory in such a manner as to preserve the true moisture content of the coal shall be used. In general, the principal sources of published analyses of samples suitable for coal classification are the publications of the U.S. Bureau of Mines, the U.S. Geological Survey, and the Canadian Department of Mines. Suitable analyses are published also by some of the State Surveys and some of the Provinces of Canada. However, it must be kept in mind that many of the bed sample analyses of the governmental organizations are from prospects in which the coal may have been altered by exposure. Such samples shall not be used for classification. Analyses published prior to 1904 are unlikely to represent the true moisture content of coal and, even after this date, analyses from sources other than governmental laboratories are not likely to be representative with respect to moisture.

X1.2 In view of the importance of the fixed carbon in coal classification, special attention is called to the 1913 revision in this method by the American Chemical Society.[6] The revision was substantially the same as that introduced by the U.S. Bureau of Mines[7] a few years earlier, as a result of finding large discrepancies between results of the Pittsburgh, PA, and Washington, DC, laboratories. A considerable number of analyses were made before it was discovered that the natural-gas burners at the Pittsburgh laboratory gave high results for fixed carbon.[8] For this reason, the fixed carbon results of the U. S. Geological Survey or U.S. Bureau of Mines analyses designated by Laboratory Nos. 5147 to 9120, inclusive, shall not be used for the classification of coal.

X1.3 All analyses made by any laboratory prior to 1913 should be rejected unless there is positive evidence that the methods of analysis were essentially those adopted by ASTM in 1913.

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[6] Preliminary Report of the Joint Committee on Coal Analysis of the American Society for Testing and Materials and the American Chemical Society, *Journal of Industrial and Engineering Chemistry*, Vol 5, 1913, p. 517; see also Report of Subcommittee IV on Volatile Matter, *Proceedings*, Am. Soc. Testing Mats., Vol. XIV, Part I, 1914, p. 424.

[7] Fieldner, A. C., and Selvig, W. A., "Notes on the Sampling and Analysis of Coal," U. S. Bureau of Mines, *Technical Paper No. 586*, 1938, p. 9.

[8] Lord, N. W., Holmes, J. A., Stanton, F. M., Fieldner, A. C., and Sanford, S., "Analyses of Coals in the United States," U. S. Bureau of Mines, *Bulletin No. 22*, Part I, 1913, p. 28.

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, Pa. 19103.

Designation: F 499 – 84

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Standard Practice for
INSTALLATION OF WOOD UNDERLAYMENT AND PREPARATION OF THE SURFACE TO RECEIVE RESILIENT FLOORING[1]

This standard is issued under the fixed designation F 499; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the installation of plywood, particleboard, and hardboard underlayment on a subfloor and the preparation of the underlayment surface prior to installation of resilient flooring. This practice also covers the preparation of the surface of combination subfloor-underlayment systems.

1.2 This practice points out the factors that must be controlled in preparing underlayment as a base for resilient flooring.

1.3 This practice does not cover the structural adequacy of the subfloor or combination subfloor-underlayment which is governed by applicable regulatory agencies, nor does it apply to wood underlayment over concrete floors.

1.4 This practice does not supersede in any manner the underlayment manufacturer's or the resilient flooring manufacturer's instructions. Consult the individual manufacturer for specific recommendations.

1.5 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standard:*

D 805 Methods of Testing Veneer, Plywood, and Other Glued Veneer Constructions[2]

2.2 *Other Documents:*

PS 1-74 U.S. Product Standard, Construction and Industrial Plywood[3]

PS 58-74 U.S. Standard, Basic Hardboard[3]

CS236-66 U.S. Commercial Standard[3]

NPA 3-73 Specification for Particleboard Floor Underlayment Coated With Wax-Polymer Type Hot Melt Coatings[4]

3. Definitions

3.1 *resilient flooring*—resilient material in tile or sheet form (non-textile) that is used to cover the underlayment referred to in this practice.

3.2 *glue-nailing*—a system for installing underlayment using both mechanical fasteners and adhesives.

3.3 *subfloor*—that structural layer intended to provide support for design loadings which may receive resilient floor coverings directly if the surface is appropriate or indirectly via an underlayment if its surface is not suitable.

3.4 *subfloor underlayment*—a structural floor system in which the upper surface is designed and constructed for the direct installation of resilient floor coverings.

3.5 *underlayment*—that layer of material usually installed on or over a subfloor that provides a surface suitable to receive resilient floor covering.

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[1] This practice is under the jurisdiction of ASTM Committee F-6 on Resilient Floor Coverings and is the direct responsibility of Subcommittee F06.60 on Installation of Resilient Floor Coverings.

Current edition approved June 29, 1984. Published August 1984. Originally published as F 499 – 77. Last previous edition F 499 – 78.

[2] Discontinued—See *1982 Annual Book of ASTM Standards*, Part 22.

[3] Available from Naval Publications and Forms Center, 5801 Tabor Ave., Phila. PA 19120.

[4] Available from National Particle Board Association, 2306 Perkins Place, Silver Spring, MD 20910.

4. Materials and Manufacture

4.1 For the purposes of this practice, underlayment shall be one of the materials listed in Table 1.

5. Storage and Handling of Underlayment

5.1 The underlayment materials included in this practice are hygroscopic in nature and respond to variations in atmospheric temperature and relative humidity by dimensional changes, and other effects caused by changes in moisture content. Therefore, store underlayment flat on skids in a dry place and protect from wetting. Underlayment should not be stored outdoors. To avoid damage and excessive moisture pickup, bring underlayment to the jobsite just prior to the time it will be needed.

6. Preparation of Subfloor

6.1 The subfloor shall be of wood construction, dry, level, securely nailed, and reasonably clean, without projections. Loose boards or panels should be renailed. Renail or replace badly cupped or warped board subfloors if they cannot be made smooth and level.

6.2 Crawl spaces, underneath wood subfloors, shall be well ventilated and have clearance of at least 18 in. (457 mm) between the ground level and the joists. Place a vapor barrier having a maximum rating of 1.0 perm on the ground under the wood floor to reduce the amount of moisture to which the floor will be exposed. Joints in the vapor barrier should be overlapped at least 6 in. (152 mm).

6.3 To minimize localized drying and shrinking of floors, areas close to furnaces and heat ducts may need to be insulated.

7. Installation of Underlayment

7.1 To minimize damage caused by other trades, follow the procedures in Section 8. Installation should be delayed until the construction has reached the approximate moisture content that it will have in service. For best results, the moisture content of the underlayment should approximate that which it will have in service. Panels that have been exposed to high humidity prior to application should be separated with sticks and allowed to dry.

7.2 The underlayment thicknesses and fastenings in Table 2 are recommended. (More nails should be used if required to hold the underlayment in close contact with the subfloor.)

7.3 *Glue-Nailing*—Plywood and particleboard underlayment can be glue-nailed to the subfloor.

7.3.1 Apply a hard setting casein glue meeting Federal Specification MMM-A-125 Type II or a poly(vinyl acetate) floor underlayment glue (recommended by the adhesive manufacturer for this purpose) to the subfloor using a notched trowel, roller, or brush; and fasten the underlayment in the following manner:

7.3.1.1 *Plywood*—Use a 2-in. (51-mm) wide strip at panel edges and 2-in. wide strip across the ends and across the width of the panel at intervals of 12 in. (305 mm) for ¼-in. (6.35-mm) underlayment and 16 in. (406 mm) for underlayment ⅜ in. (9.5 mm) and thicker. Fasteners for the glue-nailed installation should be in accordance with Table 2. Nail spacing for plywood should be 12 in. (305 mm) on center at panel edges and along the glue strips. Increased spacing is not recommended for staples.

7.3.1.2 *Particleboard*—Use a 12-in. (305-mm) wide strip at panel ends and 3-in. (76-mm) wide strip along panel edges, and 6-in. (152-mm) wide strip down the center of the panel parallel to panel edges. Particleboard of ⅜-in. (9.5-mm) minimum thickness may be glue-nailed to ½-in. (13-mm) minimum thickness plywood subfloors. A minimum underlayment thickness of ½ in. may be glue-nailed to 8-in. (203-mm) maximum width board subfloors. Fasteners for glue-nailing particleboard underlayment should be spaced 16-in. (406-mm) on center at panel edges and in both directions at interior locations and should be the size prescribed in Table 2 for the same thickness of underlayment.

7.4 *Joint Spacing*—All underlayment panels should be butted to a light contact. Leave a ⅛-in. (3.2-mm) space between plywood or hardboard underlayment and walls and approximately ⅜ in. (9.5 mm) between particleboard underlayment and walls.

7.5 *Placement of Underlayment Panels*—Stagger underlayment panel end joints with respect to each other and offset all joints with respect to the joints in the subfloor at least 2 in. (51 mm) (to the middle of boards if less than 4 in. (102 mm) wide).

7.5.1 *Plywood Subfloors*—Offset underlayment panel joints from plywood subfloor panel end joints at least one joist (see Fig. 1).

7.5.2 *Board Subfloors Perpendicular to Joists*—Apply underlayment panels across the subfloor with edge joints parallel to and over a joist (see Fig. 2).

7.5.3 *Board Subfloors at an Angle to Joists*—Apply underlayment panels perpendicular to joists with end joints parallel to and over a joist (see Fig. 3).

8. Protection from Other Trades

8.1 Because satisfactory performance of the finish flooring depends in part on the condition of the surface of the underlayment, care should be taken to avoid traffic on the underlayment after installation. Trade workers that might cause damage to the underlayment surface should complete their work prior to installation of underlayment. Damage to the underlayment surface or the resilient flooring installation can occur if water, oil, paint, solvent, dirt, and other debris are spilled or tracked onto the underlayment. The underlayment should be protected by temporary walking boards or several sheets of heavy paper.

9. Preparation of Underlayment Surface

9.1 These provisions also apply to plywood and particleboard installed as combination subfloor-underlayment. Final preparation of the underlayment surface should be accomplished just prior to application of the floor covering.

9.1.1 Protruding nails should be driven flush.

9.1.2 All joints should be sanded smooth with a power sander. Avoid oversanding.

9.1.3 Gouges, chipped areas, and open joints should be filled with a hardsetting filler intended for this purpose, such as latex-type compounds or other nonshrinking, noncrumbling, patching compounds. Fillers should be allowed to dry and then sanded smooth.

TABLE 1 Recommended Materials for Underlayment

NOTE 1—In those areas exposed to moisture, such as bathrooms and laundry rooms, plywood bonded with exterior glue should be used.

NOTE 2—Flooring adhesive to be used should be recommended by the flooring manufacturer for use on hot melt coated particleboard.

Material	Standard	Recommended Grades
Plywood	U.S. Product Standard PS 1-74	underlayment (Note 1) underlayment with exterior glue C-C (Plugged) Ext.
Particleboard	U.S. Commercial Standards CS236-66 National Particleboard Association NPA 3-73	floor underlayment Type 1-B-1 coated floor underlayment (Note 2)
Hardboard	Product Standard PS 58-73	class 4, service grade sanded or planed on one side to a uniform thickness (± 0.005 in.). Use 3 by 4-ft or 4 by 4-ft sizes.

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TABLE 2 Recommended Underlayment Thicknesses and Fastenings

NOTE—1 in. = 25.4 mm

Underlayment	Subfloor	Minimum Underlayment Thickness (Nominal)	Underlayment Thickness	Fastener[D]	Nail Spacing, (in.)	
					Panel Edges	Interior both Directions
Plywood[A,B]	Plywood (1/2 in. and thicker)	1/4 in.	1/4 in.	1 1/4 in. (3d) underlayment nails	3	6
			3/8 to 1/2 in.	1 1/4 in. (3d) underlayment nails	6	8
			5/8 to 3/4 in.	1 1/2 in. (4d) underlayment nails	6	8
			1/4 in.	18 g staples × 3/16 in. × 7/8 in.	3	6
			3/8 in. and thicker	16 g staples × 3/8 in. × (underlayment thickness + 5/8 in.)	3	6
	boards up to 4 in. wide	1/4 in.[C]	same as for plywood subfloor			
	boards 4 in. and wider	3/8 in.	same as for plywood subfloor			
Particleboard[B]	plywood (5/8 in. and thicker)	1/4 in.	less than 5/8 in.	1 1/2 in. (4d) underlayment nails	3	6
			5/8 to 3/4 in.	2 in. (6d) underlayment nails	6	10
			1/4 in.	18 g staples × 3/16 in. × 7/8 in.	3	6
			3/8 in.	16 g staples × 3/8 in. × 1 1/8 in.	3	6
			1/2 to 5/8 in.	16 g staples × 3/8 in. × 1 5/8 in.	3	6
	boards less than 8 in. wide	3/8 in.	same as for 5/8 in. plywood subfloor			
Hardboard[B]	all of the above subfloors	0.215 in.	0.215 in.	1 1/4 in. (3d) underlayment nails	3	6
				18 g staples × 3/16 in. × 7/8 in.	3	6

[A] Staples should have crowns parallel to the plywood face grain.

[B] Position fasteners 1/2 in. in from panel edges.

[C] Species Group 1 under U. S. Product Standard PS 1-74. For other species groups, use minimum of 3/8 in.

[D] Nails should be annularly threaded underlayment nails. Staples should be galvanized and have divergent chisel points. Fastenings should commence in the center of a panel and progress toward edges. Fasteners should be driven flush.

APPENDIX

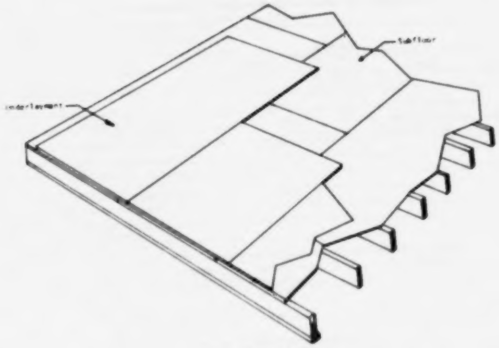
Subfloor
Underlayment

FIG. 1 Plywood Subfloors

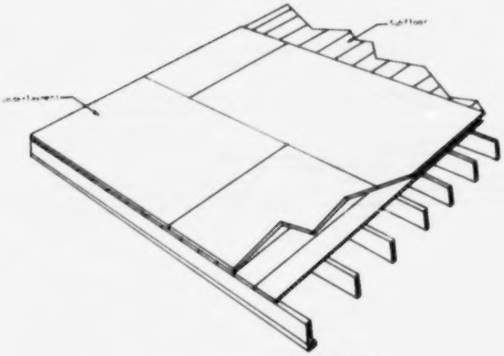
Subfloor
Underlayment

FIG. 2 Board Subfloors Perpendicular to Joists

APPENDIX

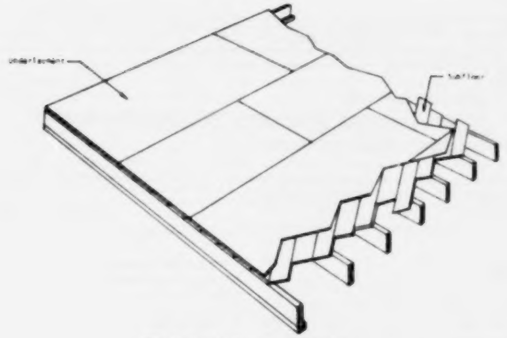

FIG. 3 Board Subfloors at an Angle to Joists

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Standard Guide for
USING EXISTING PRACTICES IN DEVELOPING AND WRITING TEST METHODS[1]

This standard is issued under the fixed designation D 4270; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

$^{\epsilon 1}$ Note—Editorial changes were made throughout in February 1986.

1. Scope

1.1 This guide is intended to assist task groups in the preparation of a test method. It can help the task group use existing statistically related ASTM practices more effectively during the development and writing of the test method.

1.2 Some of the essential activities that should occur during the development of a new test method are not in existing or proposed practices under the jurisdiction of ASTM Subcommittee D13.93 on Statistics. This guide includes a brief explanation of how such activities should be carried out.

1.3 This guide is applicable to properties that are evaluated by both parametric and nonparametric methods of estimation. The instructions on properties that are best evaluated by nonparametric methods are less complete than those for properties that are evaluated by parametric methods.

2. Referenced Documents

2.1 *ASTM Standards:*

D 123 Terminology Relating to Textiles[2]

D 2904 Practice for Interlaboratory Testing of Textiles[3]

D 2905 Practice for Statement on Number of Specimens for Textiles[3]

D 2906 Practice for Statements on Precision and Bias for Textiles[3]

D 3777 Practice for Writing Specifications for Textiles[2]

D 4271 Practice for Writing Statements on Sampling in Test Methods for Textiles[3]

E 691 Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *practice, n*—a definitive procedure for performing one or more specific operations or functions that does not produce a test result.

3.1.1.1 *Discussion*—A practice is not a downgraded test method. Examples of practices include procedures for conducting interlaboratory testing programs or other statistical procedures; for writing statements on sampling or precision and accuracy; and for selection, preparation, application, inspection, necessary precautions for use or disposal, installation, maintenance, and operation of testing equipment.

3.1.2 *test method, n*—a definitive procedure for the identification, measurement, or evaluation of one or more qualities, characteristics, or properties of a material, product, system, or service that produces a test result.

3.1.3 For the definitions of other terms that appear in this standard, refer to Terminology D 123.

3.2 *Descriptions of Terms Specific to this Standard:*

3.2.1 *sensitivity criterion, n*—a quantitative measure of the relative merit of two test methods, that combines the estimated variance of each method with the ability of the method to measure differences in the property of interest.

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[1] This guide is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.93 on Statistics.

Current edition approved July 29, 1983. Published September 1983.

[2] *Annual Book of ASTM Standards*, Vols 07.01 and 07.02.

[3] *Annual Book of ASTM Standards*, Vol 07.01.

[4] *Annual Book of ASTM Standards*, Vol 14.02.

3.2.2 *parametric, adj*—a term referring to a statistical technique that assumes the nature of the underlying frequency distribution is known.

3.2.3 *nonparametric, adj*—a term referring to a statistical technique that does not assume the nature of the underlying frequency distribution is known.

4. Uses and Significance

4.1 There are enough existing practices related to the development of test methods or the preparation of one or more sections of new test methods so that even the experienced author may not use them as effectively as possible. This guide shows the person(s) preparing a new test method where and when the existing practices can best be used.

4.2 Using this standard as a guide, a task group should be able to prepare a draft of a new test in less time and with less effort than if this guide were not used. In addition, a well-prepared draft of a new test method is less likely to receive negative votes.

5. Determining Need for a Method

5.1 There is no simple answer to the question: "Is a new test method needed?" Generally, a new test method is needed if *(1)* no ASTM test method exists to identify, measure, or evaluate one or more significant qualities, characteristics, or properties of a material, product, system, or service and *(2)* need for such a method exists on an industry-wide basis. The responsible subcommittee needs to be convinced that a true need exists and be agreed upon the exact nature of the quality, characteristic, or property of interest to be evaluated. It is essential that a test method measure a quality, characteristic, or property that will predict the usefulness of a material, product, system, or service when it is put to its intended use.

6. Evaluating Potential Methods

6.1 *Sources of Potential Methods*—Potential procedures for a proposed new test method usually come from two sources: either one or more companies or laboratories have a method that is being used by them, or someone has decided that a specific procedure is a reasonable one to use even though it has not been used in industry. Existing procedures may be modified by the task group in the light of a consensus of viewpoints.

6.2 *Applicability of Potential Methods*—The first job of the task group is to consider each of the potential methods and determine if the method really measures the property of interest or whether it measures some related property instead. A specific procedure can usually be investigated within a single laboratory. In the light of these findings, a judgment should be made whether each of the potential methods is worthy of further work. In addition, if the method is supposed to predict performance in a later stage in the life of a material or product, the task group needs to verify that the method will really do so. At this point, the task group should eliminate any potential test procedure that does not meet these requirements. If all of the potential procedures are eliminated, the task group should make every reasonable attempt to discover or invent a procedure that does meet these requirements. Failure to do so will mean that the selected test method will not be as good as the users have a right to expect.

6.3 *Initial Test Method Tolerances*—Subcommittee D13.93 on Statistics is developing a practice that discusses the fact that the tolerances specified for each of the measurements of some characteristic of a test specimen determine the exactness with which a test really can realistically be reported. For example, a procedure for determining mass per unit area of a fabric specimen should require that the length and width of the specimen be measured to within some tolerance and the mass to within another tolerance. If these tolerances are broad, it will not be realistic to require reporting the mass per unit area quite exactly. Before starting work on the one or more potential procedures that are still under consideration, the task group should select consistent test method tolerances.

6.4 *Reducing Variability*—It is quite likely that the results for each of the potential test methods include variability that might be eliminated or reduced by changes in the procedure. Subcommittee D13.93 on Statistics is preparing a practice that discusses how to locate the sources of such unnecessary variability and how to eliminate them by *(1)* using ruggedness tests, *(2)* evaluating and using components of variance (*3*) averaging results from more than one specimen, (*4*) compositing samples prior to testing, and (*5*) using physical standards to reduce time related changes in the method or equipment. A brief description of ruggedness testing and a set of references are given in Practice D 2904. The task group should contact a person with statistical experience for help with the methods of eliminating unnecessary variability listed above.

6.5 *Statistical Control*—Useful testing procedures should be in a state of statistical control; that is, the long-term variability should be no greater than is predicted from the short-term variability. Guidance is given in 6.4 for detecting and eliminating assignable causes of increased long-term variability. The existence of a state of statistical control can be demonstrated by control charts prepared as directed in ASTM STP 15D.[5]

6.5.1 Checking the statistical control of a test procedure requires having a number of specimens that are as nearly homogeneous as possible. Two operators might each test one randomly assigned specimen daily for twenty or more days, and plot the daily average of these two test results. Control limits should then be calculated using both Eq 1 and Eq 2.

$$\bar{\bar{X}} \pm 1.880\ \bar{R} \qquad (1)$$

$$\bar{\bar{X}} \pm 2.66\ \bar{R}_m \qquad (2)$$

where:

$\bar{\bar{X}}$ = grand average of all observations,

$\bar{R}$ = average range or the average of the differences between the two observations on single days, and

$\bar{R}_m$ = average moving range, or the average of the difference between successive daily averages

6.5.2 If all of the daily averages are within the limits calculated using Eq 1, the testing procedure is in an excellent state of control. If some of the daily averages are outside the limits obtained using Eq 1 but all are within the somewhat wider limits usually obtained using Eq 2, the testing procedure is within a minimum acceptable state of control. In this second case there is more variability from day to day than would be expected from the within-day variability, but the long-term day to day variability is comparable to the short term day to day variability.

6.6 *Revised Test Method Tolerances*—If any significant improvements are made in the test procedure(s) as a result of 6.4 or 6.5, review and possibly revise the test method tolerances.

7. Selecting the Procedure to be Used

7.1 For each procedure still under consideration, write a draft of the sections on apparatus, conditioning (if applicable), procedure, and reporting. Use the *Form and Style for ASTM Standards* (*Blue Book*) and the White Paper on preparing standards for Committee D-13 as guides in preparing these sections.[6] These sections should be in the proper form and complete enough for the user to find answers to all procedural questions instead of having to assume an answer that might differ from that of another user.

7.2 If there are still two procedures under consideration, make a choice based on the relative sensitivity, cost, and complexity of the methods.[7] If there are three or more procedures under consideration, get statistical help in selecting the procedure to be used. If the choice of a procedure is not rather obvious, defer the final decision on the choice until after the pilot interlaboratory tests have been run as directed in 8.3. The relative sensitivity of two test methods can be compared as directed in a practice being developed by Subcommittee D13.93 on Statistics.

8. Interlaboratory Testing

8.1 An interlaboratory testing program should not be started until the task group is satisfied that all possible sources of unnecessary variability have been eliminated from each procedure still being considered. An interlaboratory testing program is essentially worthless as a means of detecting and eliminating unnecessary sources of variability. Embarking on such a program before thorough use of such practices as those specified in Section 6 often results in data that are so bad that the interlaboratory test data must be discarded, the procedure(s) improved as directed in Section 6, and the interlaboratory test repeated. This approach is a costly and time consuming error in procedure. Often some of the laboratories included in the first interlaboratory test program may not be able to take part in a second such test program.

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[5] *Manual on Presentation of Data and Control Chart Analysis, ASTM STP 15 D*, ASTM, 1976.

[6] Available from ASTM Headquarters, 1916 Race St., Philadelphia, PA 19103.

[7] Mandel, J. and Stiehler, R. D., *Journal of Research of the National Bureau of Standards*, Vol 53, 1954, p. 155 and same authors, Analytical Chemistry, Vol 29, 1957, p. 17A.

8.2 Before any work is done on interlaboratory testing, the task group should be satisfied with the draft sections on apparatus, conditioning, procedure, and reporting for any procedures still being considered. The task group may prefer to submit these draft sections to an informal ballot of the entire subcommittee before considering interlaboratory testing.

8.3 Refer to Practice D 2904 or Practice E 691 for the planning and analysis of the interlaboratory test program. If there has been no final choice of alternative procedures, run pilot scale interlaboratory tests on each of the procedures still under consideration. If the procedures in 6.4 have been properly carried out and there is a clear cut choice of a procedure, the primary virtue of a pilot scale interlaboratory test is that it checks out the adequacy of the draft sections on apparatus, conditioning, procedure, and reporting.

8.3.1 Both Practice D 2904 and Practice E 691 are oriented toward test procedures that produce observations best evaluated by parametric methods of estimation. If the data from the interlaboratory test program are expected to be best evaluated by nonparametric methods at estimation, it is imperative for this fact to be considered during the planning of the program. Under these conditions, it is advisable to consult the practice on interlaboratory testing when data are not normally distributed being developed by Subcommittee D13.93 on Statistics and to obtain qualified statistical help in the planning and evaluation of an interlaboratory test program and in the preparation of statements on precision and bias. Recommended Texts 3, 4, 5, and 8 in Practice D 2906 apply to such data and should be studied before beginning an interlaboratory test program.

8.4 After the interlaboratory test results are all available, analyze the data for one material at a time and calculate the components of variance for laboratories, operators within a laboratory, and specimens within operators and laboratories for each of the materials. Make a judgment as to whether the results for each type of material differ enough for precision to be reported separately for the different materials. Practice E 691 provides some general guidance in making such a judgment, but discusses an experimental design that does not consider the possibility of variability between operators in a single laboratory.

8.4.1 If the decision is that the materials do not differ enough to require separate reporting by materials, combine the data for all of the materials into an analysis of variance table like that in Table A10 of Practice D 2904. Calculate the components of variance using the equations in Table A10 of Practice D 2904, tabulate the results as shown in Table A11 of Practice D 2904, and form estimates of the single-operator component, the within-laboratory component, and the between laboratory component as directed in Annex A4 of Practice D 2904. It may be advisable to get statistical assistance in performing these tasks.

9. Preparation of Complete Draft

9.1 Expand to a complete draft the partial draft specified in 7.1. Prepare the statistically related sections as directed in the following sections.

9.2 Use Section 4 of Practice D 2906 to prepare a statement on *Uses and Significance* about the use of the test method for acceptance testing of commercial shipments.

9.3 Use Practice D 3777 to plan the requirements for sampling. Use Practice D 4271 to write a section on sampling. If appropriate, use Practice D 2905 to write instructions on how a user is to calculate the number of specimens per subunit of the laboratory sample.

9.4 Use Practice D 2906 to prepare statements on precision and bias.

10. Review of Draft

10.1 Before sending the draft out to ballot, send a copy of the draft to Subcommittee D13.91 on Editorial Policy for an editorial review. Contact the D-13 Staff Manager at ASTM Headquarters for additional information.

11. Ballots

11.1 Upon agreement by the subcommittee at a regular meeting, send the draft out for a subcommittee ballot. The easiest way to initiate a subcommittee ballot is for the secretary of the subcommittee to send a copy of the draft to the staff person from the Standards Development Division of ASTM who is currently responsible for Committee D-13. The draft should be accompanied by a cover letter requesting a subcommittee ballot and stating whether the responses are to be sent to headquarters for later reporting to the subcommittee or to a member of the subcommittee. Alternatively, the secretary of the subcommittee can prepare and distribute the subcommittee ballot.

11.2 Upon completion of a satisfactory subcommittee ballot, the draft is ready for a Committee D-13 ballot. Requests for a Committee D-13 ballot should be sent by the subcommittee secretary to the responsible staff manager. The appropriate forms are available on request from the D-13 staff manager.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

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Standard for METRIC PRACTICE

E 380-86

ASTM STANDARD
FOR
METRIC PRACTICE

E 380-86

PCN 03-503886-85

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Standard for
METRIC PRACTICE[1]

This standard is issued under the fixed designation E 380; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards, with the following exception: the DoD policy for the spelling of meter and liter is "-er," with the provision that agencies have the option of using "-re" when appropriate in international relations.

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[1] This standard is under the jurisdiction of ASTM Committee E-43 on Metric Practice and is the direct responsibility of Subcommittee E43.10 on Standards.

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1. Scope

1.1 This standard gives guidance for application of the modernized metric system in the United States. The International System of Units, developed and maintained by the General Conference on Weights and Measures (abbreviated CGPM from the official French name Conférence Générale des Poids et Mesures) is intended as a basis for worldwide standardization of measurement units. The name International System of Units and the international abbreviation SI[2] were adopted by the 11th CGPM in 1960. SI is a complete, coherent system that is being universally adopted.

1.2 Information is included on SI, a limited list of non-SI units recognized for use with SI units, and a list of conversion factors from non-SI to SI units, together with general guidance on proper style and usage.

1.3 It is hoped that an understanding of the system and its characteristics, and careful use according to this standard, will help to avoid the degradation that has occurred in all older measurement systems.

2. SI Units and Symbols

2.1 *Classes of Units*—SI units are divided into three classes:

base units
supplementary units
derived units

2.2 *Base Units*—SI is based on seven well-defined units (see Table 1) which by convention are regarded as dimensionally independent.

2.3 *Supplementary Units*—This class contains two units, the radian and the steradian (see Table 2). At the time of the introduction of the International System, the 11th CGPM left open the question of the nature of these supplementary units. Considering that plane angle is generally expressed as the ratio between two lengths and solid angle as the ratio between an area and the square of length, the CIPM (1980) specified that in the International System the quantities plane angle and solid angle should be considered as dimensionless derived quantities. Therefore, the supplementary units radian and steradian are to be regarded as dimensionless derived units which may be used or omitted in the expressions for derived units.

2.4 *Derived Units*:

TABLE 1 Base SI Units

Quantity[3]	Unit	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature[A]	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd

[A] For a discussion of Celsius temperature see 3.4.2.

TABLE 2 Supplementary SI Units

Quantity[3]	Unit	Symbol
plane angle	radian	rad
solid angle	steradian	sr

2.4.1 Derived units are formed by combining base units, supplementary units, and other derived units according to the algebraic relations linking the corresponding quantities. The symbols for derived units are obtained by means of the mathematical signs for multiplication, division, and use of exponents. For example, the SI unit for velocity is the metre per second (m/s or $m \cdot s^{-1}$), and that for angular velocity is the radian per second (rad/s or $rad \cdot s^{-1}$).

2.4.2 Those derived SI units which have special names and symbols approved by the CGPM are listed in Table 3.

2.4.3 It is frequently advantageous to express derived units in terms of other derived units with special names; for example, the SI unit for electric dipole moment is usually expressed as $C \cdot m$ instead of $A \cdot s \cdot m$.

2.4.4 Some common derived units are listed in Table 4.

2.5 *SI Prefixes* (see 3.2 for application):

2.5.1 The prefixes and symbols listed in Table 5 are used to form names and symbols of the decimal multiples and submultiples of the SI units except for kilogram.

2.5.2 *Unit of Mass*—Among the base and derived units of SI, the unit of mass (kilogram) is the only one whose name, for historical reasons, contains a prefix. Names of decimal multiples and submultiples of the unit of mass are formed by attaching prefixes to the word *gram* (g).

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[2] From the French name, Le Système International d'Unités.

[3] "Quantity" as used in the headings of the tables of this standard means measurable attribute of phenomena or matter.

TABLE 3 Derived SI Units with Special Names

Quantity[5]	Unit	Symbol	Formula
frequency (of a periodic phenomenon)	hertz	Hz	1/s
force	newton	N	$kg \cdot m/s^2$
pressure, stress	pascal	Pa	N/m^2
energy, work, quantity of heat	joule	J	$N \cdot m$
power, radiant flux	watt	W	J/s
quantity of electricity, electric charge	coulomb	C	$A \cdot s$
electric potential, potential difference, electromotive force	volt	V	W/A
electric capacitance	farad	F	C/V
electric resistance	ohm	Ω	V/A
electric conductance	siemens	S	A/V
magnetic flux	weber	Wb	$V \cdot s$
magnetic flux density	tesla	T	Wb/m^2
inductance	henry	H	Wb/A
Celsius temperature	degree Celsius[A]	°C	K[see 3.4.2]
luminous flux	lumen	lm	$cd \cdot sr$
illuminance	lux	lx	lm/m^2
activity (of a radionuclide)	becquerel	Bq	1/s
absorbed dose[B]	gray	Gy	J/kg
dose equivalent	sievert	Sv	J/kg

[A] Inclusion in the table of derived SI units with special names approved by the CIPM in 1976.

[B] Related quantities using the same unit are: specific energy imparted, kerma, and absorbed dose index.

2.5.3 These prefixes or their symbols are directly attached to names or symbols of units, forming multiples and submultiples of the units. In strict terms these must be called "multiples and submultiples of SI units," particularly in discussing the coherence of the system (see Section 5). In common parlance, the base units and derived units, along with their multiples and submultiples, are all called SI units.

3. Application of the Metric System

3.1 *General*—SI is the form of the metric system that is preferred for all applications. It is important that this modernized form of the metric system be thoroughly understood and properly applied. Obsolete metric units and practices are widespread, particularly in those countries that long ago adopted the metric system, and much usage is improper. This section gives guidance concerning the limited number of cases in which units outside SI are appropriately used, and makes recommendations concerning usage and style.

3.2 *Application of SI Prefixes:*

3.2.1 *General*—In general the SI prefixes (2.5) should be used to indicate orders of magnitude, thus eliminating nonsignificant digits and leading zeros in decimal fractions, and providing a convenient alternative to the powers-of-ten notation preferred in computation. For example:

12 300 mm becomes 12.3 m
12.3×10^3 m becomes 12.3 km
0.00123 μA becomes 1.23 nA

3.2.2 *Selection*—When expressing a quantity by a numerical value and a unit, a prefix should preferably be chosen so that the numerical value lies between 0.1 and 1000. To minimize variety, it is recommended that prefixes representing 1000 raised to an integral power be used. However, three factors may justify deviation from the above:

3.2.2.1 In expressing area and volume, the prefixes hecto-, deka-, deci-, and centi- may be required, for example, square hectometre, cubic centimetre.

3.2.2.2 In tables of values of the same quantity, or in a discussion of such values within a given context, it is generally preferable to use the same unit multiple throughout.

3.2.2.3 For certain quantities in particular applications, one particular multiple is customarily used. For example, the millimetre is used for linear dimensions in mechanical engineering drawings even when the values lie far outside the range 0.1 to 1000 mm; the centimetre is often used for body measurements and clothing sizes.

3.2.3 *Prefixes in Compound Units*[6]—It is recommended that only one prefix be used in forming a multiple of a compound unit. Normally the prefix should be attached to a unit in the numerator. One exception to this is when the kilogram occurs in the denominator.

Examples:

V/m, *not* mV/mm, and MJ/kg, *not* kJ/g

3.2.4 *Compound Prefixes*—Compound prefixes, formed by the juxtaposition of two or more SI prefixes are not to be used. For example, use

1 nm, *not* 1 mμm
1 pF, *not* 1 μμF

---

[6] A compound unit is a derived unit that is expressed in terms of two or more units rather than by a single special name.

TABLE 4 Some Common Derived Units of SI

Quantity[A]	Unit	Symbol
absorbed dose rate	gray per second	Gy/s
acceleration	metre per second squared	m/s^{2}
angular acceleration	radian per second squared	rad/s^{2}
angular velocity	radian per second	rad/s
area	square metre	m^{2}
concentration (of amount of substance)	mole per cubic metre	mol/m^{3}
current density	ampere per square metre	A/m^{2}
density, mass	kilogram per cubic metre	kg/m^{3}
electric charge density	coulomb per cubic metre	C/m^{3}
electric field strength	volt per metre	V/m
electric flux density	coulomb per square metre	C/m^{2}
energy density	joule per cubic metre	J/m^{3}
entropy	joule per kelvin	J/K
exposure (X and gamma rays)	coulomb per kilogram	C/kg
heat capacity	joule per kelvin	J/K
heat flux density irradiance	watt per square metre	W/m^{2}
luminance	candela per square metre	cd/m^{2}
magnetic field strength	ampere per metre	A/m
molar energy	joule per mole	J/mol
molar entropy	joule per mole kelvin	J/(mol·K)
molar heat capacity	joule per mole kelvin	J/(mol·K)
moment of force[A]	newton metre	N·m
permeability (magnetic)	henry per metre	H/m
permittivity	farad per metre	F/m
power density	watt per square metre	W/m^{2}
radiance	watt per square metre steradian	W/(m^{2}·sr)
radiant intensity	watt per steradian	W/sr
specific heat capacity	joule per kilogram kelvin	J/(kg·K)
specific energy	joule per kilogram	J/kg
specific entropy	joule per kilogram kelvin	J/(kg·K)
specific volume	cubic metre per kilogram	m^{3}/kg
surface tension	newton per metre	N/m
thermal conductivity	watt per metre kelvin	W/(m·K)
velocity	metre per second	m/s
viscosity, dynamic	pascal second	Pa·s
viscosity, kinematic	square metre per second	m^{2}/s
volume	cubic metre	m^{3}
wave number	1 per metre	1/m

[A] See 3.4.4.

TABLE 5 SI Prefixes

Multiplication Factor	Prefix	Symbol
1 000 000 000 000 000 000 = 10^{18}	exa	E
1 000 000 000 000 000 = 10^{15}	peta	P
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto[A]	h
10 = 10^{1}	deka[A]	da
0.1 = 10^{-1}	deci[A]	d
0.01 = 10^{-2}	centi[A]	c
0.001 = 10^{-3}	milli	m
0.000 001 = 10^{-6}	micro	μ
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

[A] To be avoided where practical, except as noted in 3.2.2.

TABLE 6 Units in Use with SI

Quantity	Unit	Symbol	Definition
time	minute	min	1 min = 60 s
	hour	h	1 h = 60 min = 3600 s
	day	d	1 d = 24 h = 86 400 s
	week, month, etc	—	
plane angle	degree	°	1° = (π/180) rad
	minute[A]	′	1′ = (1/60)° = (π/10 800) rad
	second[A]	″	1″ = (1/60)′ = (π/648 000) rad
volume	litre[B]	L	1 L = 1 dm^3 = 10^{-3} m^3
mass	metric ton	t	1 t = 10^3 kg
area	hectare	ha	1 ha = 1 hm^2 = 10^4 m^2

[A] Use discouraged except for special fields such as cartography

[B] See 3.3.2.4

If values are required outside the range covered by the prefixes, they should be expressed by using powers of ten applied to the base unit.

3.2.5 *Powers of Units*—An exponent attached to a symbol containing a prefix indicates that the multiple or submultiple of the unit (the unit with its prefix) is raised to the power expressed by the exponent. For example:

$$1\ \text{cm}^3 = (10^{-2}\ \text{m})^3 = 10^{-6}\ \text{m}^3$$
$$1\ \text{ns}^{-1} = (10^{-9}\ \text{s})^{-1} = 10^9\ \text{s}^{-1}$$
$$1\ \text{mm}^2/\text{s} = (10^{-3}\ \text{m})^2/\text{s} = 10^{-6}\ \text{m}^2/\text{s}$$

3.2.6 *Calculations*—Errors in calculations can be minimized if the base and the coherent derived SI units are used and the resulting numerical values are expressed in powers-often notation instead of using prefixes.

3.3 *Other Units*:

3.3.1 *Units from Different Systems*—To assist in preserving the advantage of SI as a coherent system, it is advisable to minimize the use with it of units from other systems. Such use should be limited to units listed in this section.

3.3.2 *Units in Use with SI (see Table 6)*:

3.3.2.1 *Time*—The SI unit of time is the second. This unit is preferred and should be used if practical, particularly when technical calculations are involved. In cases where time relates to life customs or calendar cycles, the minute, hour, day, and other calendar units may be necessary. For example, vehicle speed will normally be expressed in kilometres per hour.

3.3.2.2 *Plane Angle*—The SI unit for plane angle is the radian. Use of the degree and its decimal submultiples is permissible when the radian is not a convenient unit. Use of the minute and second is discouraged except for special fields such as cartography.

3.3.2.3 *Area*—The SI unit of area is the square metre (m^2). The hectare (ha) is a special name for square hectometre (hm^2). Large land or water areas are generally expressed in hectares or in square kilometres (km^2).

3.3.2.4 *Volume*—The SI unit of volume is the cubic metre. This unit, or one of the regularly formed multiples such as the cubic centimetre, is preferred. The special name *litre*[5] (L)[6] has been approved for the cubic decimetre, but use of this unit is restricted to volumetric capacity, dry measure, and measure of fluids (both gases and liquids). No prefix other than milli- or micro- should be used with litre.

3.3.2.5 *Mass*—The SI unit of mass is the kilogram. This unit, or one of the multiples formed by attaching an SI prefix to *gram* (g), is preferred for all applications. The megagram (Mg) is the appropriate unit for measuring large masses such as have been expressed in tons. However, the name *ton* has been given to several large mass units that are widely used in commerce and technology—the long ton of 2240 lb, the short ton of 2000 lb, and metric ton of 1000 kg (also called the *tonne*). None of these terms are SI. The term *metric ton* should be restricted to commercial usage, and no prefixes should be used with it. Use of the term *tonne* is deprecated.

3.3.3 *Units in Use with SI Temporarily* (see Table 7):

3.3.3.1 *Energy*—The SI unit of energy, the

---

[5] See Appendix X1.11.1.

[6] The CGPM in October 1979 approved L and l as alternative symbols for litre. Since the letter symbol l can easily be confused with the numeral 1, only the symbol L is recommended for USA use.

TABLE 7 Units in Use with SI Temporarily

Quantity[5]	Unit	Symbol	Definition
energy [see 3.3.3.1]	kilowatthour	kWh	1 kWh = 3.6 MJ
cross section	barn	b	1 b = 10^{-28} m^2
pressure [see 3.3.3.2]	bar	bar	1 bar = 10^5 Pa
activity (of a radionuclide)	curie	Ci	1 Ci = 3.7×10^{10} Bq
exposure (X and gamma rays)	roentgen	R	1 R = 2.58×10^{-4} C/kg
absorbed dose	rad	rd	1 rd = 0.01 Gy

joule, together with its multiples, is preferred for all applications. The kilowatthour is widely used, however, as a measure of electric energy. This unit should not be introduced into any new areas, and eventually it should be replaced by the megajoule.

3.3.3.2 *Pressure and Stress*—The SI unit of pressure and stress is the pascal (newton per square metre) and with proper SI prefixes is applicable to all such measurements. Old metric gravitational units for pressure and stress such as kilogram-force per square centimetre (kgf/cm^2) shall not be used. Widespread use has been made of other non-SI units such as bar and torr for pressure, but this use is strongly discouraged. The millibar is widely used in meteorology; this usage will continue for the present in order to permit meteorologists to communicate easily within their profession. The kilopascal should be used in presenting meteorological data to the public.

3.3.4 *Units and Names to Be Abandoned*—A great many metric units other than those of the SI have been defined over the years. Some of these are used only in special fields; others have found broad application in countries that adopted the metric system early. Except for the special cases discussed in the previous sections, non-SI units (as well as special names for multiples or submultiples of SI units) are to be avoided. Various categories of deprecated units are discussed in 3.3.4.1 to 3.3.4.4. The lists are not intended to be complete, but only to indicate more or less prominent examples of each category.

3.3.4.1 *Cgs Units*—All units peculiar to the various cgs systems (measurement systems constructed by using the centimetre, gram, and second as base units) are to be avoided. Among these units are the following, defined for mechanics, fluid mechanics, and photometry: the erg, dyne, gal, poise, stokes, stilb, phot, and lambert. Further use of the cgs units of electricity and magnetism is deprecated. This statement applies to the units designated by the general abbreviations "esu" (for electrostatic cgs unit) and "emu" (for electromagnetic cgs unit), including those units that have been given special names—the gauss, oersted, maxwell, gilbert, biot, and franklin. It also applies to the unit names formed with the prefixes ab- and stat-, for example, the abampere, statvolt, etc.

3.3.4.2 *Decimal Multiples of SI Units*—Those multiples of SI units that cannot be handled by using the SI prefixes are deprecated. Many such examples are covered in subsection 3.3.4.1. An additional example is the angstrom (0.1 nm).

3.3.4.3 *Unit Names to Be Avoided*—Special names for multiples and submultiples of SI units are to be avoided except for the *litre* (3.3.2.4), *metric ton* (3.3.2.5), and *hectare* (3.3.2.3). For example, do not use:

fermi	1 fermi	= 1 fm = 10^{-15} m
micron	1 micron	= 1 µm = 10^{-6} m
millimicron	1 millimicron	= 1 nm = 10^{-9} m
are	1 are	= 1 dam^2 = 100 m^2
gamma (magnetic flux density)	1 gamma	= 1 nT
γ (mass)	1 γ	= 1 µg
λ (volume)	1 λ	= 1 µL = 1 mm^3
mho	1 mho	= 1 S
candle	1 candle	= 1 cd
candlepower	1 candlepower	= 1 cd

3.3.4.4 *Miscellaneous Units*—Other non-SI units that are deprecated include the following:

calorie
grade [1 grade = (π/200) rad]
kilogram-force
langley (= 1 cal/cm^2)
metric carat
metric horsepower
millimetre of mercury
millimetre, centimetre, metre of water
standard atmosphere
  (1 atm = 101.325 kPa)
technical atmosphere
  (1 at = 98.0665 kPa)
torr

3.4 *Other Recommendations Concerning Units*:

3.4.1 *Mass, Force, and Weight*:

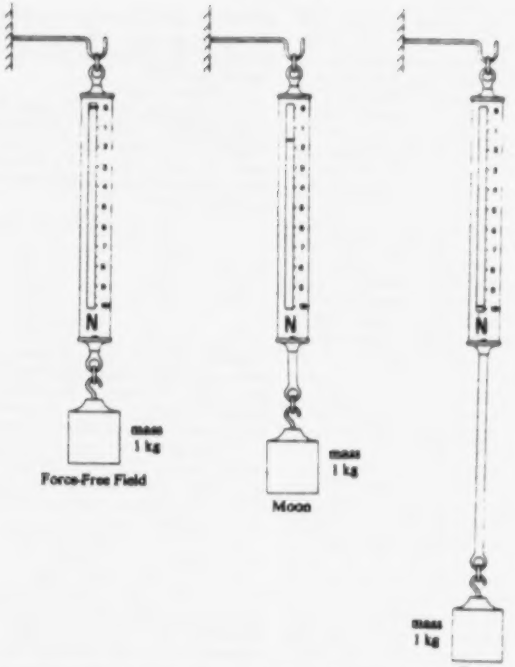

FIG. 1 Illustration of Difference Between Mass (Unit = kilogram = kg) and Force (Unit = newton = N) (see 3.4.1)

3.4.1.1 The principal departure of SI from the gravimetric system of metric engineering units is the use of explicitly distinct units for mass and force. In SI, the name kilogram is restricted to the unit of mass, and the kilogram-force (from which the suffix *force* was in practice often erroneously dropped) should not be used. In its place the SI unit of force, the newton, is used (see Fig. 1). Likewise, the newton rather than the kilogram-force is used to form derived units which include force, for example, pressure or stress ($N/m^2 = Pa$), energy ($N \cdot m = J$), and power ($N \cdot m/s = W$).

3.4.1.2 Considerable confusion exists in the use of the term *weight* as a quantity to mean either *force* or *mass*. In commercial and everyday use, the term *weight* nearly always means mass; thus, when one speaks of a person's weight, the quantity referred to is mass. This nontechnical use of the term weight in everyday life will probably persist. In science and technology, the term *weight of a body* has usually meant the force that, if applied to the body, would give it an acceleration equal to the local acceleration of free fall. The adjective "local" in the phrase "local acceleration of free fall" has usually meant a location on the surface of the earth; in this context the "local acceleration of free fall" has the symbol *g* (commonly referred to as "acceleration of gravity") with observed values of g differing by over 0.5 % at various points on the earth's surface. The use of *force of gravity* (mass times acceleration of gravity) instead of *weight* with this meaning is recommended. Because of the dual use of the term weight as a quantity, this term should be avoided in technical practice except under circumstances in which its meaning is completely clear. When the term is used, it is important to know whether mass or force is intended and to use SI units properly as described in 3.4.1.1, by using kilograms for mass or newtons for force.

3.4.1.3 Gravity is involved in determining mass with a balance or scale. When a standard mass is used to balance the measured mass, the effects of gravity on the two masses are equalized, but the effects of the buoyancy of air or other fluid on the two masses are generally not equalized. When a spring scale is used, the scale reading is directly related to the force of gravity. Spring scales graduated in mass units may be properly used if both the variation in acceleration of gravity and the buoyancy corrections are not significant in their use.

3.4.1.4 The use of the same name for units of force and mass causes confusion. When the non-SI units are used, a distinction should be made between *force* and *mass*, for example, lbf to denote force in gravimetric engineering units and lb for mass.

3.4.1.5 The term *load* means either mass or force, depending on its use. A load that produces a vertically downward force because of the influence of gravity acting on a mass may be expressed in mass units. Any other load is expressed in force units.

3.4.2 *Temperature*—The SI unit of thermodynamic temperature is the kelvin (K), and this unit is properly used for expressing thermodynamic temperature and temperature intervals. Wide use is also made of the degree Celsius (°C), which is the SI unit used for expressing Celsius temperature and temperature intervals. The Celsius scale (formerly called centigrade) is related directly to thermodynamic temperature (kelvins) as follows:

The temperature interval one degree Celsius equals one kelvin exactly.
Celsius temperature (t) is related to thermodynamic temperature (T) by the equation:

$$t = T - T_0$$

where $T_0 = 273.15$ K by definition.

The International Practical Temperature Scale (IPTS) must be recognized in temperature work of extreme precision. See *ASTM STP 565, Evolution of the International Practical Temperature Scale of 1968.*

3.4.3 *Linear Dimensions:*

3.4.3.1 Nominal dimensions name the item; no SI equivalent is required (see Section 5 for definition of "nominal value"). For example, there is nothing "1 in" about a nominal "1-in pipe," the dimensions of which should be converted as follows:

Nominal Size, inches	Outside Diameter, inches (mm)	Wall Thickness, inches (mm)		
		Sch 40	Sch 80	Sch 160
1	1.315 (33.40)	0.133 (3.38)	0.179 (4.55)	0.250 (6.35)

Likewise, a "2 by 4" is that in name only and refers to the approximate dimensions in inches of a rough-sawn piece of green lumber, the finished dimensions of which are considerably less. A ¼-20 UNC screw thread should continue to be identified in this manner. However, the controlling dimensions of the part, such as the pitch, major, and minor diameters of a screw thread, should be converted to SI values in accordance with 4.1 and 4.2.

3.4.3.2 Surface texture should be expressed in micrometres.

3.4.4 *Torque and Related Quantities:*

3.4.4.1 The determination of the SI units for torque and for other related quantities depends on whether the radian is omitted or used in expressions for derived units (see 2.3).

NOTE—The radian is omitted when torque is defined as a vector product; it is used when torque is defined as a component of an energy integral ($\int T d\theta$).

3.4.4.2 When the radian is omitted, the unit for torque and bending moment is N · m; the unit for moment of inertia is $\text{kg} \cdot \text{m}^2$; and the unit for moment of momentum is $\text{kg} \cdot \text{m}^2/\text{s}$. The unit N · m is convenient to use in the solution of problems in statics.

3.4.4.3 When the radian is used, the unit for torque is N · m/rad or J/rad; the unit for moment of inertia is $\text{kg} \cdot \text{m}^2/\text{rad}^2$; and the unit for moment of momentum is $\text{kg} \cdot \text{m}^2/(\text{rad} \cdot \text{s})$. In the solution of problems that involve rotation, the use of radian in these units will retain all advantages of dimensional analysis.

3.4.4.4 The use of the unit N · m for torque and bending moment may result in confusion with the use of the unit N·m for mechanical energy. If vectors were shown, the distinction between mechanical energy and torque would be obvious since torque is the product of moment arm and force perpendicular to the moment arm, while mechanical energy is the product of force and displacement in the direction of the force. It is important to recognize this difference when N·m is used as the unit for torque. The joule, which is a special name for the unit of energy, should not be used for the torque unit N·m but may be used in the torque unit J/rad when rotation is involved and work occurs.

3.4.5 *Impact Energy Absorption*—This quantity, often incorrectly called impact resistance or impact strength, is measured in terms of the work required to break a standard specimen; the proper unit is joule.

3.4.6 *Pressure and Vacuum*—Gage pressure is absolute pressure minus ambient pressure (usually atmospheric pressure). Both gage pressure and absolute pressure are properly expressed in pascals, using SI prefixes as appropriate. Absolute pressure is never negative. Gage pressure is positive if above ambient pressure and negative if below. Pressure below ambient is often called vacuum; whenever the term *vacuum* is applied to a numerical measure it should be made clear whether negative gage pressure or absolute pressure is meant. See 3.5.5 for methods of designating gage pressure and absolute pressure.

3.4.7 *Dimensionless Quantities*:

3.4.7.1 The values of so-called dimensionless quantities, as for example refractive index and relative permeability, are expressed by pure numbers. In these cases the corresponding SI unit is the ratio of the same two SI units and may be expressed by the number 1.

3.4.7.2 Terms such as percent, parts per thousand, and parts per million may also be used.

3.4.7.3 In all cases, the meaning must be unequivocal. Expressions like "The mole fraction of CO_2 in the sample was 1.2 parts per million" or "The mass fraction of CO_2 in the sample was 1.2 parts per million" are permissible, but would not be permissible if the word "mole" in the first expression or "mass" in the second expression were not present.

3.5 *Style and Usage*—Care must be taken to use unit symbols properly, and international agreement provides uniform rules. Handling of unit names varies because of language differences, but use of the rules included here will improve communications in the United States.

3.5.1 *Rules for Writing Unit Symbols*:

3.5.1.1 Unit symbols should be printed in upright type regardless of the type style used in the surrounding text.

3.5.1.2 Unit symbols are unaltered in the plural.

3.5.1.3 Unit symbols are not followed by a period except when used at the end of a sentence.

3.5.1.4 Letter unit symbols are written in lower-case (for example, cd) unless the unit name has been derived from a proper name, in which case the first letter of the symbol is capitalized (for example, W, Pa). The exception is the symbol for litre, L. Prefix symbols use either lower-case or upper-case letters as shown in 2.5.1. Symbols retain their prescribed form regardless of the surrounding typography. For symbols for use in systems with limited character sets, refer to ANSI X3.50 or ANSI/IEEE 260, as applicable. The symbols in ANSI X3.50 are intended for applications in the field of information processing, where unambiguous transmission of information between computers is required. The symbols in ANSI/IEEE 260 are generally consistent with those in ANSI X3.50 and are intended for communication between human beings. The symbols for limited character sets must never be used when the available character set permits the use of the proper general-use symbols as given in this standard.

3.5.1.5 When a quantity is expressed as a numerical value and a unit symbol, a space should be left between them. For example, use 35 mm, *not* 35mm, and 2.37 lm (for 2.37 lumens), *not* 2.37lm.

Exception: No space is left between the numerical value and the symbols for degree, minute, and second of plane angle, and degree Celsius. For example, use 45°, 20°C.

3.5.1.6 When a quantity expressed as a number and a unit is used in an adjectival sense, it is preferable to use a hyphen instead of a space between the number and the unit name or between the number and the symbol. Examples: A three-metre pole . . . The length is 3 m . . . A 35-mm film . . . The width is 35 mm. However, per 3.5.1.5 Exception, a 90° angle . . . an angle of 90°.

3.5.1.7 No space is used between the prefix and unit symbols.

3.5.1.8 Symbols, not abbreviations, should be used for units. For example, use "A" and not "amp" for ampere.

3.5.2 *Rules for Writing Names*:

3.5.2.1 Spelled-out unit names are treated as common nouns in English. Thus, the first letter of a unit name is not capitalized except at the beginning of a sentence or in capitalized material such as a title.

3.5.2.2 Plurals are used when required by the rules of English grammar and are normally formed regularly, for example, henries for the plural of henry. The following irregular plurals are recommended:

Singular	Plural
lux	lux
hertz	hertz
siemens	siemens

3.5.2.3 No space or hyphen is used between the prefix and unit name. There are three cases where the final vowel in the prefix is commonly omitted: *megohm*, *kilohm*, and *hectare*. In all other cases where the unit name begins with a vowel both vowels are retained and both are pronounced.

3.5.3 *Units Formed by Multiplication and Division*:

3.5.3.1 With unit names:

Product, use a space (preferred) or hyphen:

newton metre *or* newton-metre

In the case of the watt hour the space may be omitted, thus:

watthour

Quotient, use the word *per* and not a solidus:

metre per second, *not* metre/second

Powers, use the modifier *squared* or *cubed* placed after the unit name:

metre per second squared

In the case of area or volume, the modifier may be placed before the unit name:

square millimetre, cubic metre

This alternative is also allowed for derived units that include area or volume:

watt per square metre

NOTE—To avoid ambiguity in complicated expressions, symbols are preferred over words.

3.5.3.2 With unit symbols:

Product, use a raised dot:

N·m for newton metre

In the case of W·h, the dot may be omitted, thus:

Wh

An exception to this practice is made for computer printouts, automatic typewriter work, etc, where the raised dot is not possible, and a dot on the line may be used.

Quotient, use one of the following forms:

$$\mathrm{m/s}\ \textit{or}\ \mathrm{m\cdot s^{-1}}\ \textit{or}\ \frac{\mathrm{m}}{\mathrm{s}}$$

In no case should more than one solidus be used in the same expression unless parentheses are inserted to avoid ambiguity. For example, write:

$$\mathrm{J/(mol\cdot K)}\ \textit{or}\ \mathrm{J\cdot mol^{-1}\cdot K^{-1}}\ \textit{or}\ \mathrm{(J/mol)/K},$$

but *not*

J/mol/K

3.5.3.3 Symbols and unit names should not be mixed in the same expression. Write:

joules per kilogram *or* J/kg *or* $\mathrm{J\cdot kg^{-1}}$

but *not*

joules/kilogram *nor* joules/kg *nor* $\mathrm{joules\cdot kg^{-1}}$

3.5.4 *Numbers*:

3.5.4.1 The recommended decimal marker is a dot on the line. When writing numbers less than one, a zero should be written before the decimal marker.

3.5.4.2 Outside the United States, the comma is often used as a decimal marker. In some applications, therefore, the common practice in the United States of using the comma to separate digits into groups of three (as in 23,478) may cause ambiguity. To avoid this potential source of confusion, recommended international practice calls for separating the digits into groups of three, counting from the decimal point toward the left and the right, and using a small space to separate the groups. In numbers of four digits on either side of the decimal point the space is usually not necessary, except for uniformity in tables.

Examples:

2.141 596 73 722 7372 0.1335

Where this practice is followed, the space should be narrow (approximately the width of the letter "i"), and the width of the space should be constant even if, as is often the case in printing, variable-width spacing is used between words. Exceptions: In certain specialized applications, such as engineering drawings and financial statements, the practice of using a space for a separator is not customary.

3.5.4.3 Because *billion* means a thousand million (prefix *giga*) in the United States but a million million (prefix *tera*) in most other countries, this term and others, such as trillion, should be avoided in technical writing.

3.5.4.4 Use of M to indicate thousands, as in MCF for thousands of cubic feet, or in MCM for thousands of circular mils, of MM to indicate millions, of C to indicate hundreds, etc., is deprecated because of obvious conflicts with the SI prefixes.

3.5.5 *Attachment*—Attachment of letters to a unit symbol as a means of giving information about the nature of the quantity under consideration is incorrect. Thus MWe for "megawatts electrical (power)," Vac for "volts ac," and kJt for "kilojoules thermal (energy)" are not acceptable. For this reason, no attempt should be made to construct SI equivalents of the abbreviations "psia" and "psig," so often used to distinguish between absolute and gage pressure. If the context leaves any doubt as to which is meant, the word *pressure* must be qualified appropriately. For example:

> ". . . at a gage pressure of 13 kPa"

or

> ". . . at an absolute pressure of 13 kPa"

Where space is limited, such as on gages, nameplates, graph labels, and in table headings, it is permissible to use the unit symbol followed by a space and the modifier in parentheses. For example: V(ac) and V(dc); kPa (gage) and kPa (absolute).

3.5.6 *Pronunciation*—Some recommended pronunciations in English are shown in Table 8.

TABLE 8 **Recommended Pronunciation**

Prefix	Pronunciation (USA)[A]
exa	ex' a (*a* as in *about*)
peta	pet' a (*e* as in *pet*, *a* as in *about*)
tera	as in *terra firma*
giga	jig' a (*i* as in *jig*, *a* as in *about*)
mega	as in *megaphone*
kilo	kill' oh
hecto	heck' toe
deka	deck' a (*a* as in *about*)
deci	as in *decimal*
centi	as in *centipede*
milli	as in *military*
micro	as in *microphone*
nano	nan' oh (*an* as in *ant*)
pico	peek' oh
femto	fem' toe (*fem* as in *feminine*)
atto	as in *anatomy*
Selected Units	**Pronunciation**
candela	can *dell'* a
joule	rhyme with *tool*
kilometre	*kill'* oh metre
pascal	rhyme with *rascal*
siemens	same as *seamen's*

[A] The first syllable of every prefix is accented to assure that the prefix will retain its identity. Therefore, the preferred pronunciation of kilometre places the accent on the first syllable, *not* the second.

4. Rules for Conversion and Rounding

4.1 *General:*

4.1.1 Appendix X3 contains conversion factors that give exact values or seven-digit accuracy for implementing these rules except where the nature of the dimension makes this impractical.

4.1.2 Conversion of quantities should be handled with careful regard to the implied correspondence between the accuracy of the data and the given number of digits. In all conversions, the number of significant digits retained should be such that accuracy is neither sacrificed nor exaggerated. (For guidance concerning significant digits see 4.3.) For example, a length of 125 ft converts exactly to 38.1 m. If, however, the 125-ft length had been obtained by rounding to the nearest 5 ft, the conversion should be given as 38 m, and if it had been obtained by rounding to the nearest 25 ft, the conversion should be given as 40 m.

4.1.3 Proper conversion procedure is to multiply the specified quantity by the conversion factor exactly as given in Appendix X3 and then round to the appropriate number of significant digits. For example, to convert 3 feet 2$\frac{9}{16}$ inches to metres: $(3 \times 0.3048) + (2.5625 \times 0.0254) = 0.979\ 487\ 5$ m, which rounds to 0.979 m. Do not round either the conversion factor or the quantity before performing the multiplication, as accuracy may be reduced. After the conversion, the SI value may be expressed by a multiple or submultiple unit of SI by the use of an appropriate prefix, for example, 979 mm.

4.2 *Accuracy and Rounding*—Accurate conversions are obtained by multiplying the specific quantity by the appropriate conversion factor given in Appendix X3. However, this product will usually imply an accuracy not intended by the original value. Proper conversion procedure includes rounding this converted quantity to the proper number of significant digits commensurate with its intended precision. The practical aspect of measuring must be considered when using SI equivalents. If a scale having division of $\frac{1}{16}$ inch was suitable for making the original measurements, a metric scale having divisions of 1 mm is obviously suitable for measuring in SI units. Similarly, a gage or caliper graduated in divisions of 0.02 mm is comparable to one graduated in divisions of 0.001 in. Analogous situations exist in mass, force, and other measurements. Many techniques are used to guide the determination of the proper number of significant digits in the converted values. Two different approaches to rounding of quantities are here described—one for general use and the other for conversion of dimensions involving mechanical interchangeability.

4.2.1 *General Conversion*—This approach depends on first establishing the intended precision or accuracy of the quantity as a necessary guide to the number of digits to retain. This precision should relate to the number of digits in the original, but in many cases this is not a reliable indicator. A figure 1.1875 may be a very accurate decimalization of a noncritical $1\frac{3}{16}$ that should have been expressed 1.19. On the other hand, the value 2 may mean "about 2," or it may mean a very accurate value of 2 which should have been written 2.0000. It is therefore necessary to determine the intended precision of a quantity before converting. This estimate of intended precision should never be smaller than the accuracy of measurement and should usually be smaller than one tenth the tolerance if one exists. After estimating the precision of the dimension, the converted dimension should be rounded to a minimum number of significant digits (see 4.3) such that a unit of the last place is equal to or smaller than the converted precision. Examples:

1. A stirring rod 6 in long. In this case, precision is estimated to be about ½ in (± ¼ in). Converted, this is 12.7 mm. The converted dimension 152.4 mm should be rounded to the nearest 10 mm, or 150 mm.

2. 50 000 lbf/in^2 (psi) tensile strength. In this case, precision is estimated to be about ± 200 lbf/in^2 (± 1.4 MPa) based on an accuracy of ± 0.25 % for the tensile tester and other factors. Therefore, the converted dimension, 344.7379 MPa, should be rounded to the nearest whole unit, 345 MPa.

3. Test pressure 200 ± 15 lbf/in^2 (psi). Since one tenth of the tolerance is 3 lbf/in^2 (20.68 kPa), the converted dimension should be rounded to the nearest 10 kPa. Thus, 1378.9514 ± 103.421 35 kPa becomes 1380 ± 100 kPa.

4.2.2 *Special Cases:*

4.2.2.1 Converted values should be rounded to the minimum number of significant digits that will maintain the required accuracy, as discussed in 4.1.2. In certain cases deviation from this practice to make use of convenient or whole numbers may be feasible, in which case the word "approximate" must be used following the conversion. For example:

$1\frac{7}{8}$ in = 47.625 mm exact
47.6 mm normal rounding
47.5 mm (approx) rounded to preferred number
48 mm (approx) rounded to whole number

4.2.2.2 A quantity stated as a limit, such as "not more than" or "maximum," must be handled so that the stated limit is not violated. For example, a specimen "at least 4 in wide" requires a width of at least 101.6 mm, or at least 102 mm.

4.3 *Significant Digits:*

4.3.1 When converting integral values of units, consideration must be given to the implied or required precision of the integral value to be converted. For example, the value "4 in" may be intended to represent 4, 4.0, 4.00, 4.000, or 4.0000 in, or even greater accuracy. Obviously, the converted value must be carried to a sufficient number of digits to maintain the accuracy implied or required in the original quantity.

4.3.2 Any digit that is necessary to define the specific value or quantity is said to be significant. When measured to the nearest 1 m, a distance may be recorded as 157 m; this number has three significant digits. If the measurement had been made to the nearest 0.1 m, the distance may have been 157.4 m; this number has four significant digits.

4.3.3 Zeros may be used either to indicate a specific value, like any other digit, or to indicate the order of magnitude of a number. The 1970 United States population figure rounded to thousands was 203 185 000. The six left-hand digits of this number are significant; each *measures* a value. The three right-hand digits are zeros which merely indicate the order of *magnitude* of the number rounded to the nearest thousand. The identification of significant digits is only possible through knowledge of the circumstances. For example, the number 1000 may be rounded from 965, in which case only one zero is significant, or it may be rounded from 999.7, in which case all three zeros are significant.

4.3.4 Occasionally data required for an investigation must be drawn from a variety of sources where they have been recorded with varying degrees of refinement. Specific rules must be observed when such data are to be *added, subtracted, multiplied*, or *divided*.

4.3.4.1 The rule for addition and subtraction is that the *answer* shall contain no significant digits farther to the right than occurs in the least precise number. Consider the addition of three numbers drawn from three sources, the first of which reported data in millions, the second in thousands, and the third in units:

$$\begin{array}{r} 163\ 000\ 000 \\ 217\ 885\ 000 \\ \underline{96\ 432\ 768} \\ 477\ 317\ 768 \end{array}$$

The total indicates a precision that is not valid. The numbers should first be rounded to *one significant digit* farther to the right than that of the least precise number, and the sum taken as follows:

$$\begin{array}{r} 163\ 000\ 000 \\ 217\ 900\ 000 \\ \underline{96\ 400\ 000} \\ 477\ 300\ 000 \end{array}$$

The total is then rounded to 477 000 000 as called for by the rule. Note that if the second of the figures to be added had been 217 985 000, the rounding before addition would have produced 218 000 000, in which case the 0 following 218 would have been a significant digit.

4.3.4.2 The rule for multiplication and division is that the *product* or *quotient* shall contain no more significant digits than are contained in the number with the *fewest significant digits* used in the multiplication or division. The difference between this rule and the rule for addition and subtraction should be noted; the latter rule merely requires rounding of digits that lie to the right of the last significant digit in the least precise number. The following illustration highlights this difference:

Multiplication:
113.2 × 1.43 = 161.876, rounded to 162
Division:
113.2 ÷ 1.43 = 79.16, rounded to 79.2
Addition:
113.2 + 1.43 = 114.63, rounded to 114.6
Subtraction:
113.2 − 1.43 = 111.77, rounded to 111.8

The above product and quotient are limited to three significant digits since 1.43 contains only three significant digits. In contrast, the rounded answers in the addition and subtraction examples contain four significant digits.

4.3.4.3 Numbers used in the above illustrations have all been estimates or measurements. Numbers that are exact counts are treated as though they consist of an infinite number of significant digits. More simply stated, when a count is used in computation with a measurement the number of significant digits in the answer is the same as the number of significant digits in the measurement. If a count of 40 is multiplied by a measurement of 10.2, the product is 408. However, if 40 were an estimate accurate only to the nearest 10, and hence contained but one significant digit, the product would be 400.

4.4 *Rounding Values*[7]:

4.4.1 When a figure is to be rounded to fewer digits than the total number available, the procedure should be as follows:

4.4.1.1 When the first digit discarded is less than 5, the last digit retained should not be changed. For example, 3.463 25, if rounded to four digits, would be 3.463; if rounded to three digits, 3.46.

4.4.1.2 When the first digit discarded is greater than 5, or if it is a 5 followed by at least one digit other than 0, the last digit retained should be increased by one unit. For example 8.376 52, if rounded to four digits, would be 8.377; if rounded to three digits 8.38.

4.4.1.3 When the first digit discarded is exactly 5, followed only by zeros, the last digit retained should be rounded upward if it is an odd number, but no adjustment made if it is an even number. For example, 4.365, when rounded to three digits, becomes 4.36. The number 4.355 would also round to the same value, 4.36, if rounded to three digits.

4.5 *Conversion of Linear Dimensions of Interchangeable Parts*—The use of the exact relation 1 in = 25.4 mm generally produces converted values containing more decimal places than are required for the desired accuracy. It is therefore necessary to round these values suitably and at the same time maintain the degree of accuracy in the converted values compatible with that of the original values.

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[7] Adapted from ISO R370 (7).

4.5.1 *General*—The number of decimal places given in Table 9 for rounding converted toleranced dimensions relates the degree of accuracy to the size of the tolerances specified. Two methods of using Table 9 are given: Method A, which rounds to values nearest to each limit, and Method B, which rounds to values always inside the limits.

In Method A, rounding is effected to the nearest rounded value of the limit, so that, on the average, the converted tolerances remain statistically identical with the original tolerances. The limits converted by this method, where acceptable for interchangeability, serve as a basis for inspection.

In Method B, rounding is done systematically *toward the interior* of the tolerance zone so that the converted tolerances are never larger than the original tolerances. This method must be employed when the original limits have to be respected absolutely, in particular, when components made to converted limits are to be inspected by means of original gages.

Method A—The use of this method ensures that even in the most unfavorable cases neither of the two original limits will be changed by more than 5 % of the value of the tolerance. Proceed as follows:

(*a*) Calculate the maximum and minimum limits in inches.

(*b*) Convert the corresponding two values exactly into millimetres by means of the conversion factor 1 in = 25.4 mm.

(*c*) Round the results obtained to the nearest rounded value as indicated in Table 9, depending on the original tolerance in inches, that is, on the difference between the two limits in inches.

Method B—This method must be employed when the original limits may not be violated, for instance, certain critical mating parts. In extreme cases, this method may increase the lower limit a maximum of 10 % of the tolerance and decrease the upper limit a maximum of 10 % of the tolerance.

(*a*) Proceed as in Method A step (*a*).

(*b*) Proceed as in Method A step (*b*).

(*c*) Round each limit toward the interior of the tolerance, that is, to the next lower value for the upper limit and to the next higher value for the lower limit.[8]

TABLE 9 Rounding Tolerances Inches to Millimetres

Original Tolerance, inches		Fineness of Rounding, mm
at least	less than	
0.000 04	0.000 4	0.0001
0.000 4	0.004	0.001
0.004	0.04	0.01
0.04	0.4	0.1
0.4		1

Examples:

A dimension is expressed in inches as	1.950 ± 0.016
The limits are	1.934 and 1.966
Conversion of the two limits into millimetres gives	49.1236 and 49.9364
Method A—The tolerance equals 0.032 in and thus lies between 0.004 and 0.04 in (see Table 9). Rounding these values to the nearest 0.01 mm, the values in millimetres to be employed for these two limits are	49.12 and 49.94
Method B—Rounding toward the interior of the tolerance, millimetre values for these two limits are	49.13 and 49.93

This reduces the tolerance to 0.80 instead of 0.82 mm given by Method A.

4.5.2 *Special Method for Dimensions with Plus and Minus Deviations*—In order to avoid accumulation of rounding errors, the two limits of size normally are converted separately: thus, they must first be calculated if the dimension consists of a basic size and two deviations. However (except when Method B is specified) as an alternative, the basic size may be converted to the nearest rounded value and each of the deviations converted toward the interior of the tolerance. This method, which sometimes makes conversion easier, gives the same maximum guarantee of accuracy as Method A, but usually results in smaller converted tolerances.

4.5.3 *Special Methods for Limitation Imposed by Accuracy of Measurements*—If the increment of rounding for the tolerances given in Table 9 is too small for the available accuracy of measurement, limits that are acceptable for interchangeability must be determined separately for the dimensions. For example, where accuracy of measurement is limited to 0.001 mm, study shows that values converted from 1.0000 ± 0.0005 in can be rounded to 25.413 and 25.387 mm instead of 25.4127 and 25.3873 mm with little disadvantage, since neither of the two original limits is exceeded by more than 1.2 % of the tolerance.

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[8] If the digits to be rounded are zeros, the retained digits remain unchanged.

4.5.4 *Positional Tolerance*—If the dimensioning consists solely of a positional tolerance around a point defined by a nontoleranced basic dimension, the basic dimension must be converted to the nearest rounded value and the positional variation (radius) separately converted by rounding downward.

4.5.5 *Toleranced Dimension Applied to a Nontoleranced Position Dimension*—If the toleranced dimension is located in a plane, the position of which is given by nontoleranced basic or gage dimension, such as when dimensioning certain conical surfaces, proceed as follows:

(*a*) Round the converted reference gage arbitrarily, to the nearest convenient value.

(*b*) Calculate exactly, in the converted unit of measurement, new maximum and minimum limits of the specified tolerance zone, in the new plane defined by the new basic dimension.

(*c*) Round these limits in conformity with the rules in 4.4. For example, a cone of taper 0.05 in/in has a diameter of 1.000 ± 0.002 inch in a reference plane located by the nontoleranced dimension 0.9300 in. By virtue of the taper of the cone, the limits of the tolerance zone depend on the position of the reference plane. Consequently, if the dimension 0.9300 in = 23.6220 mm is rounded to 23.600 mm (that is, a reduction of 0.022 mm), each of the two original limits, when converted exactly into millimetres, must be corrected by 0.022 × 0.05 = 0.0011 mm, in the appropriate sense, before being rounded.

4.5.6 *Consideration of Maximum and Minimum Material Condition*—The ability to assemble mating parts depends on a "go" condition at the maximum material limits of the parts. The minimum material limits, which are determined by the respective tolerances, are often not as critical from a functional standpoint. Accordingly, it may be desirable to employ a combination of Methods A and B in certain conversions by using Method B for the maximum material limits and Method A for the minimum material limits. Alternatively, it may be desirable to round automatically the converted minimum material limits outside the original limits to provide greater tolerances for manufacturing.

4.5.7 While the technique described in 4.5 provides good accuracy of conversion, it will often result in dimensions that are impractical for actual production use. For conversions intended for production, it is usually necessary to round to fewer decimal places and apply design judgment to each dimension to assure interchangeability.

4.6 *Other Units*:

4.6.1 *Temperature*—General guidance for converting tolerances from degrees Fahrenheit to kelvins or degrees Celsius is given below:

Conversion of Temperature
Tolerance Requirements

Tolerance, °F	Tolerance, K or °C
2 (±1)	1 (±0.5)
4 (±2)	2 (±1)
10 (±5)	6 (±3)
20 (±10)	11 (±5.5)
30 (±15)	17 (±8.5)
40 (±20)	22 (±11)
50 (±25)	28 (±14)

Normally, temperatures expressed in a whole number of degrees Fahrenheit should be converted to the nearest 0.5 kelvin (or degree Celsius). As with other quantities, the number of significant digits to retain will depend upon implied accuracy of the original dimension, for example:

100 ± 5°F, implied accuracy estimated to be 2°F
37.7777 ± 2.7777°C rounds to 38 ± 3°C
1000 ± 50°F, implied accuracy estimated to be 20°F
537.7777 ± 27.7777°C rounds to 540 ± 30°C

4.6.2 *Pressure or Stress*—As with other quantities, pressure or stress values may be converted by the principle given above. Values with an uncertainty of more than 2 % may be converted without rounding by approximate factors:

$$1\ \text{lbf/in}^2\ (1\ \text{psi}) = 7\ \text{kN/m}^2 = 7\ \text{kPa}$$

For conversion factors and values see Appendix X3.

5. Terminology

5.1 To help ensure consistently reliable conversion and rounding practices, a clear understanding of the related nontechnical terms is a prerequisite.

5.2 Certain terms used in this standard are defined as follows:

accuracy (as distinguished from **precision**)—the degree of conformity of a measured or calculated value to some recognized standard or specified value. This concept involves the systematic error of an operation, which is seldom negligible.

approximate value—a value that is nearly but not exactly correct or accurate.

coherent system of units—a system of units of measurement in which a small number of base units, defined as dimensionally independent, are used to derive all other units in the system by rules of multiplication and division with no numerical factors other than unity. (see Appendix X1.9).

deviation—variation from a specified dimension or design requirement, usually defining upper and lower limits. (See also **tolerance**.)

digit—one of the ten arabic numerals (0 to 9).

dimension—a geometric element in a design, such as length or angle, or the magnitude of such a quantity.

feature—an individual characteristic of a part, such as screw-thread, taper, or slot.

figure (numerical)—an arithmetic value expressed by one or more digits.

inch-pound units—units based upon the yard and the pound commonly used in the United States of America and defined by the National Bureau of Standards. Note that units having the same names in other countries may differ in magnitude.

nominal value—a value assigned for the purpose of convenient designation; existing in name only.

precision (as distinguished from **accuracy**)—the degree of mutual agreement between individual measurements, namely repeatability and reproducibility.

significant digit—any digit that is necessary to define a value or quantity (see 4.3).

tolerance—the total amount by which a quantity is allowed to vary; thus the tolerance is the algebraic difference between the maximum and minimum limits.

APPENDIXES

(Nonmandatory Information)

X1. DEVELOPMENT OF THE INTERNATIONAL SYSTEM OF UNITS

Le Système International d'Unités

X1.1 The decimal system of units was conceived in the 16th century when there was a great confusion and jumble of units of weights and measures. It was not until 1790, however, that the French National Assembly requested the French Academy of Sciences to work out a system of units suitable for adoption by the entire world. This system, based on the metre as a unit of length and the gram as a unit of mass, was adopted as a practical measure to benefit industry and commerce. Physicists soon realized its advantages and it was adopted also in scientific and technical circles. The importance of the regulation of weights and measures was recognized in Article 1, Section 8, when the United States Constitution was written in 1787, but the metric system was not legalized in this country until 1866. In 1893, the international metre and kilogram became the fundamental standards of length and mass in the United States, both for metric and customary weights and measures.

X1.2 Meanwhile, international standardization began with an 1870 meeting of 15 nations in Paris that led to the May 2, 1875, International Metric Convention, and the establishment of a permanent International Bureau of Weights and Measures near Paris. A General Conference on Weights and Measures (CGPM) was also constituted to handle all international matters concerning the metric system. The CGPM meets at least every six years in Paris and controls the International Bureau of Weights and Measures which preserves the metric standards, compares national standards with them, and conducts research to establish new standards. The National Bureau of Standards represents the United States in these activities.

X1.3 The original metric system provided a set of units for the measurement of length, area, volume, capacity, and mass based on two fundamental units: the metre and the kilogram. Measurement of additional quantities required for science and commerce has necessitated development of additional fundamental and derived units. Numerous other systems based on these two metric units have been used. A unit of time was added to produce the centimetre-gram-second (cgs) system adopted in 1881 by the International Electrical Congress. About 1900 practical measurements in metric units began to be based on the metre-kilogram-second (MKS) system. In 1935 the International Electrotechnical Commission acted favorably on a proposal originally made by Prof. Giovanni Giorgi in 1901, and recommended that the MKS system of mechanics be linked with the electromagnetic system of units by adoption of one of the units—ampere, coulomb, ohm, or volt—for a fourth base unit. Subsequently the ampere, the unit of electric current, was selected as a base unit, thus defining the MKSA system.

X1.4 The 10th CGPM in 1954 adopted a rationalized and coherent system of units based on the four MKSA units, plus the degree Kelvin as the unit of temperature and the candela as the unit of luminous intensity. The 11th CGPM in 1960 formally gave it the full title, International System of Units, for which the abbreviation is "SI" in all languages. Thirty-six countries, including the United States, participated in this 1960 conference. The 12th CGPM in 1964 made some refinements, and the 13th CGPM in 1967 redefined the second, renamed the unit of temperature as the kelvin (K), and revised the definition of the candela. The 14th CGPM in 1971 added a seventh base unit, the mole, and approved the pascal (Pa) as a special name for the SI unit of pressure or stress, the newton per square metre, and the siemens (S) as a special name for the unit of electric conductance, the reciprocal ohm or the ampere per volt. The 15th CGPM in 1975 added prefixes for 10^{18} and 10^{15}, exa (E) and peta (P) respectively, and approved two special names: the gray (Gy) as a special name for the SI unit of absorbed dose, the joule per kilogram; and the becquerel (Bq) as a special name for the SI unit of activity of a radionuclide, one per second.

X1.5 SI is a rationalized selection of units from the metric system which individually are not new. It includes a unit of force (newton) in place of the kilogram-force. SI is a coherent system with seven base units for which names, symbols, and precise definitions have been established. Many derived units are defined in terms of the base units, symbols assigned to each, and, in some cases, given names, as for example, the newton (N).

X1.6 The great advantage of SI is that there is one and only one unit for each physical quantity—the metre for length (l), kilogram (instead of gram) for mass (m), second for time (t), etc. From these elemental units, units for all other mechanical quantities are derived. These derived units are defined by simple equations such as $v = dl/dt$ (velocity), $a = dv/dt$

(acceleration), $F = ma$ (force), $W = Fl$ (work or energy), $P = W/t$ (power). Some of these units have only generic names such as metre per second for velocity; others have special names such as newton (N) for force, joule (J) for work or energy, watt (W) for power. The SI units for force, energy, and power are the same regardless of whether the process is mechanical, electrical, chemical, thermal, or nuclear. A force of 1 newton applied for a distance of 1 metre can produce 1 joule of heat, which is identical with what 1 watt of electric power can produce in 1 second.

X1.7 Corresponding to the advantages of SI, which result from the use of a unique unit for each physical quantity, are the advantages which result from the use of a unique and well-defined set of symbols. Such symbols eliminate the confusion that can arise from current practices in different disciplines such as the use of "b" for both the *bar* (a unit of pressure) and *barn* (a unit of cross section).

X1.8 Another advantage of SI is the decimal relationship between multiples and submultiples of the unit for each physical quantity—not that there is anything inherently superior in a number system to the base 10 but that SI conforms to the system of arabic numerals. Prefixes are established for designating multiple and submultiple units from "exa" (10^{18}) down to "atto" (10^{-18}) for convenience in writing and talking.

X1.9 Another major advantage of SI is its coherence. Units might be chosen arbitrarily, but making an independent choice of a unit for each category of mutually comparable quantities would lead in general to the appearance of several additional numerical factors in the equations between the numerical values. It is possible, however, and in practice more convenient, to choose a system of units in such a way that the equations between numerical values, including the numerical factors, have exactly the same form as the corresponding equations between the quantities. A unit system defined in this way is called coherent with respect to the system of quantities and equations in question. Equations between units of a coherent unit system contain as numerical factors only the number 1. In a coherent system the product or quotient of any two unit quantities is the unit of the resulting quantity. For example, in any coherent system, unit area results when unit length is multiplied by unit length, unit velocity when unit length is divided by unit time, and unit force when unit mass is multiplied by unit acceleration. Thus, in a coherent system in which the foot is a unit of length, the square foot is the unit of area (but the acre is not). Similarly in a coherent system in which the foot, the pound, and the second are units of length, mass, and time, the unit of force is the poundal (and not the pound-force).

X1.10 Whatever the system of units, whether it be coherent or noncoherent, particular samples of some physical quantities must be arbitrarily selected as units of those quantities. The remaining units are defined by appropriate experiments related to the theoretical interrelations of all the quantities. For convenience of analysis, certain units are by convention regarded as dimensionally independent; these units are called base units, and all other units (derived units) can be expressed algebraically in terms of the base units. In the SI, the unit of mass, the kilogram, is defined as the mass of a particular "prototype kilogram" preserved by the International Bureau of Weights and Measures. All other units are defined in terms of reproducible phenomena, for example, the wavelength and frequency of specified atomic transitions.

X1.11 Various other units are associated with SI but are not a part thereof. They are related to units of the system by powers of 10 and are employed in specialized branches of physics. Examples of such units are the bar, a unit of pressure, approximately equivalent to one atmosphere and equal exactly to 100 kilopascals. It is employed extensively by meteorologists. Another such unit is the gal equal exactly to an acceleration of 0.01 metre per second squared. It is used in geodetic work. These, however, are not coherent units; that is to say, equations involving these units and SI units together cannot be written without a factor of proportionality even though the factor of proportionality is a simple power of 10.

X1.11.1 Originally (1795) the litre was intended to be identical with the cubic decimetre. The Third General Conference on Weights and Measures, meeting in 1901, decided to define the litre as the volume occupied by the mass of one kilogram of pure water at its maximum density under normal atmospheric pressure. Careful determinations subsequently established the litre so defined as being equivalent to 1.000 028 dm³. In 1964 the General Conference on Weights and Measures withdrew this definition of the litre, and declared that the word "litre" was a special name for the cubic decimetre. Thus its use is permitted in SI, but is discouraged (see 3.3.2.4), since it creates two units for the same quantity, and its use in precision measurements might conflict with measurements recorded under the old definition.

X1.12 Authorized translations of the original French definitions of the seven base and two supplementary units of the International System are given in the following paragraphs:

X1.12.1 *metre*—The metre is the length of the path traveled by light in a vacuum during a time interval of 1/299 792 458 of a second. (adopted by 17th CGPM 1983)

X1.12.2 *kilogram*—The kilogram is the unit of mass; it is equal to the mass of the international prototype of the kilogram. (adopted by 1st and 3rd CGPM 1889 and 1901)

X1.12.3 *second*—The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom.[9] (adopted by 13th CGPM 1967)

X1.12.4 *ampere*—The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed one metre apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per metre of length.

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[9] This definition supersedes the ephemeris second as the unit of time.

(adopted by 9th CGPM 1948)

X1.12.5 *kelvin*—The kelvin, unit of thermodynamic temperature, is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water.[10] (adopted by 13th CGPM 1967)

X1.12.6 *mole*—The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12. (adopted by 14th CGPM 1971)

NOTE—When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

In the definition of the mole, it is understood that unbound atoms of carbon-12, at rest and in their ground state, are referred to.

X1.12.7 *candela*—The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540 × 10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian. (adopted by 16th CGPM 1979)

X1.12.8 *radian*—The radian is the plane angle between two radii of a circle which cut off on the circumference an arc equal in length to the radius.

X1.12.9 *steradian*—The steradian is the solid angle which, having its vertex in the center of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides of length equal to the radius of the sphere.

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[10] The triple point of water is 273.16 K (0.01°C), which is 0.01 K above the freezing point of water at a pressure of 101.325 kPa.

X1.13 *Definitions of Derived Units of the International System Having Special Names:*

Quantity[a]	Unit and Definition
1. Absorbed dose	The *gray* is the absorbed dose when the energy per unit mass imparted to matter by ionizing radiation is one joule per kilogram. NOTE—The *gray* is also used for the ionizing radiation quantities: specific energy imparted, kerma, and absorbed dose index, which have the SI unit joule per kilogram.
2. Activity	The *becquerel* is the activity of a radionuclide decaying at the rate of one spontaneous nuclear transition per second.
3. Celsius temperature	The *degree Celsius* is equal to the kelvin and is used in place of the kelvin for expressing Celsius temperature (symbol t) defined by the equation $t = T - T_0$ where T is the thermodynamic temperature and $T_0 = 273.15$ K by definition.
4. Dose equivalent	The *sievert* is the dose equivalent when the absorbed dose of ionizing radiation multiplied by the dimensionless factors Q (quality factor) and N (product of any other multiplying factors) stipulated by the International Commission on Radiological Protection is one joule per kilogram.
5. Electric capacitance	The *farad* is the capacitance of a capacitor between the plates of which there appears a difference of potential of one volt when it is charged by a quantity of electricity equal to one coulomb.
6. Electric conductance	The *siemens* is the electric conductance of a conductor in which a current of one ampere is produced by an electric potential difference of one volt.
7. Electric inductance	The *henry* is the inductance of a closed circuit in which an electromotive force of one volt is produced when the electric current in the circuit varies uniformly at a rate of one ampere per second.
8. Electric potential difference, electromotive force	The *volt* (unit of electric potential difference and electromotive force) is the difference of electric potential between two points of a conductor carrying a constant current of one ampere, when the power dissipated between these points is equal to one watt.
9. Electric resistance	The *ohm* is the electric resistance between two points of a conductor when a constant difference of potential of one volt, applied between these two points, produces in this conductor a current of one ampere, this conductor not being the source of any electromotive force.
10. Energy	The *joule* is the work done when the point of application of a force of one newton is displaced a distance of one metre in the direction of the force.
11. Force	The *newton* is that force which, when applied to a body having a mass of one kilogram gives it an acceleration of one metre per second squared.
12. Frequency	The *hertz* is the frequency of a periodic phenomenon of which the period is one second.
13. Illuminance	The *lux* is the illuminance produced by a luminous flux of one lumen uniformly distributed over a surface of one square metre.
14. Luminous flux	The *lumen* is the luminous flux emitted in a solid angle of one steradian by a point source having a uniform intensity of one candela.
15. Magnetic flux	The *weber* is the magnetic flux which, linking a circuit of one turn, produces in it an electromotive force of one volt as it is reduced to zero at a uniform rate in one second.
16. Magnetic flux density	The *tesla* is the magnetic flux density given by a magnetic flux of one weber per square metre.
17. Power	The *watt* is the power which gives rise to the production of energy at the rate of one joule per second.
18. Pressure or stress	The *pascal* is the pressure or stress of one newton per square metre.
19. Quantity of electricity	The *coulomb* is the quantity of electricity transported in one second by a current of one ampere.

X2. ORGANS OF THE METRE CONVENTION[11]: BIPM, CIPM, CGPM

The International Bureau of Weights and Measures (BIPM) was set up by the *Metre Convention* signed in Paris on 20 May 1875 by seventeen States during the final session of the Diplomatic Conference of the Metre. This Convention was amended in 1921.

BIPM has its headquarters near Paris, in the grounds (43 520 m^2) of the Pavillon de Breteuil (Parc de Saint-Cloud), placed at its disposal by the French Government; its upkeep is financed jointly by the Member States of the Metre Convention.[12]

The task of BIPM is to ensure worldwide unification of physical measurements; it is responsible for:

—establishing the fundamental standards and scales for measurement of the principal physical quantities and maintaining the international prototypes;

—carrying out comparisons of national and international standards;

—ensuring the co-ordination of corresponding measuring techniques;

—carrying out and co-ordinating the determinations relating to the fundamental physical constants that are involved in the above-mentioned activities.

BIPM operates under the exclusive supervision of the *International Committee for Weights and Measures* (CIPM), which itself comes under the authority of the *General Conference on Weights and Measures* (CGPM).

The General Conference consists of delegates from all the Member States of the Metre Convention and meets at present every four years. At each meeting it receives the Report of the International Committee on the work accomplished, and it is responsible for:

—discussing and instigating the arrangements required to ensure the propagation and improvement of the International System of Units (SI), which is the modern form of the metric system;

—confirming the results of new fundamental metrological determinations and the various scientific resolutions of international scope;

—adopting the important decisions concerning the organization and development of BIPM.

The International Committee consists of eighteen members each belonging to a different State; it meets at present once every year. The officers of this Committee issue an *Annual Report* on the administrative and financial position of BIPM to the Governments of the Member States of the Metre Convention.

The activities of BIPM, which in the beginning were limited to the measurements of length and mass and to metrological studies in relation to these quantities, have been extended to standards of measurement for electricity (1927), photometry (1937), and ionizing radiations (1960). To this end the original laboratories, built in 1876–1878, were enlarged in 1929 and two new buildings were constructed in 1963–1964 for the ionizing radiation laboratories. Some thirty physicists or technicians work in the laboratories of BIPM. They do metrological research, and also undertake measurement and certification of material standards of the above-mentioned quantities. BIPM's annual appropriation is of the order of 8 600 000 gold francs, approximately 3 400 000 U.S. dollars (in 1981).

In view of the extension of the work entrusted to BIPM, CIPM has set up since 1927, under the name of *Consultative Committees*, bodies designed to provide it with information on matters which it refers to them for study and advice. These Consultative Committees, which may form temporary or permanent "Working Groups" to study special subjects, are responsible for co-ordinating the international work carried out in their respective fields and proposing recommendations concerning the amendments to be made to the definitions and values of units. In order to ensure worldwide uniformity in units of measurement, the International Committee accordingly acts directly or submits proposals for sanction by the General Conference.

The Consultative Committees have common regulations (*Procès-Verbaux CIPM*, 1963, 31, 97). Each Consultative Committee, the chairman of which is normally a member of CIPM, is composed of delegates from each of the large Metrology Laboratories and specialized Institutes, a list of which is drawn up by CIPM, as well as individual members also appointed by CIPM and one representative of BIPM. These Committees hold their meetings at irregular intervals; at present there are eight of them in existence.

1. *The Consultative Committee for Electricity* (CCE), set up in 1927.
2. *The Consultative Committee for Photometry and Radiometry* (CCPR), new name given in 1971 to the Consultative Committee for Photometry set up in 1933 (between 1930 and 1933 the preceding Committee (CCE) dealt with matters concerning Photometry).
3. *The Consultative Committee for Thermometry* (CCT), set up in 1937.
4. *The Consultative Committee for the Definition of the Metre* (CCDM), set up in 1952.
5. *The Consultative Committee for the Definition of*

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[11] Reprinted from NBS 330 (15).

[12] As of 31 December 1980, forty-five States were members of this Convention: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Cameroon, Canada, Chile, China (People's Republic of), Czechoslovakia, Denmark, Dominican Republic, Egypt, Finland, France, German Democratic Republic, Germany (Federal Republic of), Hungary, India, Indonesia, Iran, Ireland, Italy, Japan, Korea (Republic of), Mexico, Netherlands, Norway, Pakistan, Poland, Portugal, Romania, Spain, South Africa, Sweden, Switzerland, Thailand, Turkey, USSR, United Kingdom, USA, Uruguay, Venezuela, Yugoslavia.

the Second (CCDS), set up in 1956.

6. *The Consultative Committee for the Standards of Measurement of Ionizing Radiations* (CCEMRI), set up in 1958.

In 1969 this Consultative Committee established four sections: Section I (measurement of X and γ rays, electrons); Section II (measurement of radionuclides); Section III (neutron measurements); Section IV (α-energy standards). In 1975 this last section was dissolved and Section II made responsible for its field of activity.

7. *The Consultative Committee for Units* (CCU), set up in 1964 (this Consultative Committee replaced the "Commission for the System of Units" set up by the CIPM in 1954).
8. *The Consultative Committee for Mass and Related Quantities* (CCM), set up in 1980.

The proceedings of the General Conference, the International Committee, the Consultative Committees, and the International Bureau are published under the auspices of the latter in the following series:

—*Comptes rendus des séances de la Conférence Générale des Poids et Mesures*;

—*Procès-Verbaux des séances du Comité International des Poids et Mesures;*

—*Sessions des Comités Consultatifs;*

—*Recueil de Travaux du Bureau International des Poids et Mesures* (this collection for private distribution brings together articles published in scientific and technical journals and books, as well as certain work published in the form of duplicated reports).

From time to time BIPM publishes a report on the development of the Metric System throughout the world, entitled *Les récents progrès du Système Métrique*.

The collection of the *Travaux et Memoires du Bureau International des Poids et Mesures* (22 volumes published between 1881 and 1966) ceased in 1966 by a decision of CIPM.

Since 1965 the international journal *Metrologia*, edited under the auspices of CIPM, has published articles on the more important work on scientific metrology carried out throughout the world, on the improvement in measuring methods and standards, on units, etc, as well as reports concerning the activities, decisions and recommendations of the various bodies created under the Metre Convention.

X3. CONVERSION FACTORS

X3.1 *General:*

X3.1.1 The following tables are an expansion of those in reference 16. They provide equivalent values in the International System of Units for miscellaneous units of measure. The numerical values are multiplying factors for converting values expressed in miscellaneous units to corresponding values expressed in SI units.

X3.1.2 The SI values are expressed in terms of the base, supplementary, and derived units of SI to provide a coherent presentation of the conversion factors and to facilitate computations. If desired, the user can avoid the powers of 10 in the factors by selecting appropriate SI prefixes (see 3.2.2) and shifting the decimal marker. For example, the factor for the thermochemical British thermal unit may be expressed by 1.054 350 kJ, and for the therm (EC) may be expressed by 105.506 MJ.

X3.1.3 A few conversion factors to non-SI units are included for convenience, for example, mile per hour to kilometre per hour.

X3.2 *Notation:*

X3.2.1 Conversion factors are presented for ready adaptation to computer readout and electronic data transmission. The factors are written as a number equal to or greater than one and less than ten with six or less decimal places. This number is followed by the letter E (for exponent), a plus or minus symbol, and two digits which indicate the power of 10 by which the number must be multiplied to obtain the correct value. For example:

$$3.523\ 907\ \mathrm{E}{-}02 \text{ is } 3.523\ 907 \times 10^{-2}$$

or

$$0.035\ 239\ 07$$

Similarly:

$$3.386\ 389\ \mathrm{E}{+}03 \text{ is } 3.386\ 389 \times 10^{3}$$

or

$$3\ 386.389$$

X3.2.2 An asterisk (*) after the sixth decimal place indicates that the conversion factor is exact and that all subsequent digits are zero. All other conversion factors have been rounded to the figures given in accordance with 4.4. Where less than six decimal places are shown, more precision is not warranted.

X3.2.3 Further example of use of tables:

To convert from:	to:	Multiply by:
pound-force per square foot	Pa	4.788 026 E+01
inch	m	2.540 000*E−02

means

$$1\ \mathrm{lbf/ft^2} = 47.880\ 26\ \mathrm{Pa}$$

$$1\ \text{inch} = 0.0254\ \mathrm{m}\ (\text{exactly})$$

X3.3 *Organization:*

X3.3.1 The conversion factors are listed in two ways—alphabetically and classified by physical quantity. Both lists contain those units which have specific names and compound units derived from these specific units. The classified list contains the more frequently used units for each physical quantity.

X3.3.2 The conversion factors for other compound units can easily be generated from numbers given in the alphabetical list by the substitution of converted units, as follows:

Example—To find conversion factor lb·ft/s to kg·m/s:

first convert 1 lb to 0.453 592 4 kg
and 1 ft to 0.3048 m
then substitute:

$$(0.453\ 592\ 4\ \mathrm{kg})\cdot(0.3048\ \mathrm{m})/\mathrm{s} = 0.138\ 255\ \mathrm{kg\cdot m/s}$$

thus the factor is 1.382 55 E−01

Example—To find conversion factor of oz·in^2 to kg·m^2:

first convert 1 oz to 0.028 349 52 kg
and 1 in^2 to 0.000 645 16 m^2
then substitute:

$$(0.028\ 349\ 52\ \mathrm{kg})\cdot(0.000\ 645\ 16\ \mathrm{m^2}) = 0.000\ 018\ 289\ 98\ \mathrm{kg\cdot m^2}$$

thus the factor is 1.828 998 E−05

ALPHABETICAL LIST OF UNITS

Factors with an asterisk (*) are exact

(Symbols of SI units given in parentheses)

To convert from	to	Multiply by
abampere	ampere (A)	1.000 000*E+01
abcoulomb	coulomb (C)	1.000 000*E+01
abfarad	farad (F)	1.000 000*E+09
abhenry	henry (H)	1.000 000*E−09
abmho	siemens (S)	1.000 000*E+09
abohm	ohm (Ω)	1.000 000*E−09
abvolt	volt (V)	1.000 000*E−08
acre foot[13]	cubic metre (m^3)	1.233 489 E+03
acre[13]	square metre (m^2)	4.046 873 E+03
ampere hour	coulomb (C)	3.600 000*E+03
angstrom	metre (m)	1.000 000*E−10
are	square metre (m^2)	1.000 000*E+02
astronomical unit	metre (m)	1.495 979 E+11
atmosphere, standard	pascal (Pa)	1.013 250*E+05
atmosphere, technical (= 1 kgf/cm^2)	pascal (Pa)	9.806 650*E+04
bar	pascal (Pa)	1.000 000*E+05
barn	square metre (m^2)	1.000 000*E−28
barrel (for petroleum, 42 gal)	cubic metre (m^3)	1.589 873 E−01
board foot	cubic metre (m^3)	2.359 737 E−03
British thermal unit (International Table)[14]	joule (J)	1.055 056 E+03
British thermal unit (mean)	joule (J)	1.055 87 E+03
British thermal unit (thermochemical)	joule (J)	1.054 350 E+03
British thermal unit (39°F)	joule (J)	1.059 67 E+03
British thermal unit (59°F)	joule (J)	1.054 80 E+03
British thermal unit (60°F)	joule (J)	1.054 68 E+03
Btu (International Table)·ft/(h·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.730 735 E+00
Btu (thermochemical)·ft/(h·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.729 577 E+00
Btu (International Table)·in/(h·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.442 279 E−01
Btu (thermochemical)·in/(h·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.441 314 E−01
Btu (International Table)·in/s·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	5.192 204 E+02
Btu (thermochemical)·in/(s·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	5.188 732 E+02
Btu (International Table)/h	watt (W)	2.930 711 E−01
Btu (International Table)/s	watt (W)	1.055 056 E+03
Btu (thermochemical)/h	watt (W)	2.928 751 E−01

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[13] The U.S. Metric Law of 1866 gave the relationship, 1 metre equals 39.37 inches. Since 1893 the U.S. yard has been derived from the metre. In 1959 a refinement was made in the definition of the yard to bring the U.S. yard and the yard used in other countries into agreement. The U.S. yard was changed from 3600/3937 m to 0.9144 m exactly. The new length is shorter by exactly two parts in a million.

At the same time it was decided that any data in feet derived from and published as a result of geodetic surveys within the U.S. would remain with the old standard (1 ft = 1200/3937 m) until further decision. This foot is named the U.S. survey foot.

All conversion factors for units of land measure in these tables referenced to this footnote are based on the U.S. survey foot and the following relationships: 1 fathom = 6 feet; 1 rod (pole or perch) = 16½ feet; 1 chain = 66 feet; 1 mile (U.S. statute) = 5280 feet.

[14] The Fifth International Conference on the Properties of Steam in 1956 defined the calorie (International Table) as 4.1868 J. Therefore, the exact conversion for Btu (International Table) is 1.055 055 852 62 E+03 J.

To convert from	to	Multiply by
Btu (thermochemical)/min	watt (W)	1.757 250 E+01
Btu (thermochemical)/s	watt (W)	1.054 350 E+03
Btu (International Table)/ft^2	joule per square metre (J/m^2)	1.135 653 E+04
Btu (thermochemical)/ft^2	joule per square metre (J/m^2)	1.134 893 E+04
Btu (International Table)/($ft^2 \cdot s$)	watt per square metre (W/m^2)	1.135 653 E+04
Btu (International Table)/($ft^2 \cdot h$)	watt per square metre (W/m^2)	3.154 591 E+00
Btu (thermochemical)/($ft^2 \cdot h$)	watt per square metre (W/m^2)	3.152 481 E+00
Btu (thermochemical)/($ft^2 \cdot min$)	watt per square metre (W/m^2)	1.891 489 E+02
Btu (thermochemical)/($ft^2 \cdot s$)	watt per square metre (W/m^2)	1.134 893 E+04
Btu (thermochemical)/($in^2 \cdot s$)	watt per square metre (W/m^2)	1.634 246 E+06
Btu (International Table)/($h \cdot ft^2 \cdot °F$) (thermal conductance)[15]	watt per square metre kelvin [$W/(m^2 \cdot K)$]	5.678 263 E+00
Btu (thermochemical)/($h \cdot ft^2 \cdot °F$)(thermal conductance)[15]	watt per square metre kelvin [$W/(m^2 \cdot K)$]	5.674 466 E+00
Btu (International Table)/($s \cdot ft^2 \cdot °F$)	watt per square metre kelvin [$W/(m^2 \cdot K)$]	2.044 175 E+04
Btu (thermochemical)/($s \cdot ft^2 \cdot °F$)	watt per square metre kelvin [$W/(m^2 \cdot K)$]	2.042 808 E+04
Btu (International Table)/lb	joule per kilogram (J/kg)	2.326 000* E+03
Btu (thermochemical)/lb	joule per kilogram (J/kg)	2.324 444 E+03
Btu (International Table)/(lb · °F) (heat capacity)	joule per kilogram kelvin [$J/(kg \cdot K)$]	4.186 800* E+03
Btu (thermochemical)/(lb · °F) (heat capacity)	joule per kilogram kelvin [$J/(kg \cdot K)$]	4.184 000* E+03
Btu (International Table)/ft^3	joule per cubic metre (J/m^3)	3.725 895 E+04
Btu (thermochemical)/ft^3	joule per cubic metre (J/m^3)	3.723 402 E+04
bushel (U.S.)	cubic metre (m^3)	3.523 907 E−02
calorie (International Table)[14]	joule (J)	4.186 800* E+00
calorie (mean)	joule (J)	4.190 02 E+00
calorie (thermochemical)	joule (J)	4.184 000* E+00
calorie (15°C)	joule (J)	4.185 80 E+00
calorie (20°C)	joule (J)	4.181 90 E+00
calorie (kilogram, International Table)	joule (J)	4.186 800* E+03
calorie (kilogram, mean)	joule (J)	4.190 02 E+03
calorie (kilogram, thermochemical)	joule (J)	4.184 000* E+03
cal (thermochemical)/cm^2	joule per square metre (J/m^2)	4.184 000* E+04
cal (International Table)/g	joule per kilogram (J/kg)	4.186 800* E+03
cal (thermochemical)/g	joule per kilogram (J/kg)	4.184 000* E+03
cal (International Table)/(g · °C)	joule per kilogram kelvin [$J/(kg \cdot K)$]	4.186 800* E+03
cal (thermochemical)/(g · °C)	joule per kilogram kelvin [$J/(kg \cdot K)$]	4.184 000* E+03
cal (thermochemical)/min	watt (W)	6.973 333 E−02
cal (thermochemical)/s	watt (W)	4.184 000* E+00
cal (thermochemical)/($cm^2 \cdot s$)	watt per square metre (W/m^2)	4.184 000* E+04
cal (thermochemical)/($cm^2 \cdot min$)	watt per square metre (W/m^2)	6.973 333 E+02
cal (thermochemical)/($cm^2 \cdot s$)	watt per square metre (W/m^2)	4.184 000* E+04
cal (thermochemical)/($cm \cdot s \cdot °C$)	watt per metre kelvin [$W/(m \cdot K)$]	4.184 000* E+02
cd/in^2	candela per square metre (cd/m^2)	1.550 003 E+03
carat (metric)	kilogram (kg)	2.000 000* E−04
centimetre of mercury (0°C)	pascal (Pa)	1.333 22 E+03
centimetre of water (4°C)	pascal (Pa)	9.806 38 E+01
centipoise (dynamic viscosity)	pascal second ($Pa \cdot s$)	1.000 000* E−03
centistokes (kinematic viscosity)	square metre per second (m^2/s)	1.000 000* E−06
chain[12]	metre (m)	2.011 684 E+01
circular mil	square metre (m^2)	5.067 075 E−10
clo	kelvin square metre per watt ($K \cdot m^2/W$)	1.55 E−01
cup	cubic metre (m^3)	2.365 882 E−04
curie	becquerel (Bq)	3.700 000* E+10
darcy[16]	square metre (m^2)	9.869 233 E−13
day	second (s)	8.640 000* E+04

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[15] In ISO 31 this quantity is called *coefficient of heat transfer*.

[16] The darcy is a unit for measuring permeability of porous solids.

To convert from	to	Multiply by
day (sidereal)	second (s)	8.616 409 E+04
degree (angle)	radian (rad)	1.745 329 E−02
degree Celsius	kelvin (K)	$T_K = t_{^\circ C} + 273.15$
degree centigrade	[see 3.4.2]	
degree Fahrenheit	degree Celsius (°C)	$t_{^\circ C} = (t_{^\circ F} - 32)/1.8$
degree Fahrenheit	kelvin (K)	$T_K = (t_{^\circ F} + 459.67)/1.8$
degree Rankine	kelvin (K)	$T_K = T_{^\circ R}/1.8$
°F·h·ft^2/Btu (International Table) (thermal resistance)[17]	kelvin square metre per watt (K·m^2/W)	1.761 102 E−01
°F·h·ft^2/Btu (thermochemical) (thermal resistance)[17]	kelvin square metre per watt (K·m^2/W)	1.762 280 E−01
°F·h·ft^2/[Btu (International Table)·in] (thermal resistivity)	kelvin metre per watt (K·m/W)	6.933 471 E+00
°F·h·ft^2/[Btu (thermochemical)·in] (thermal resistivity)	kelvin metre per watt (K·m/W)	6.938 113 E+00
denier	kilogram per metre (kg/m)	1.111 111 E−07
dyne	newton (N)	1.000 000* E−05
dyne·cm	newton metre (N·m)	1.000 000* E−07
dyne/cm^2	pascal (Pa)	1.000 000* E−01
electronvolt	joule (J)	1.602 19 E−19
EMU of capacitance	farad (F)	1.000 000* E+09
EMU of current	ampere (A)	1.000 000* E+01
EMU of electric potential	volt (V)	1.000 000* E−08
EMU of inductance	henry (H)	1.000 000* E−09
EMU of resistance	ohm (Ω)	1.000 000* E−09
ESU of capacitance	farad (F)	1.112 650 E−12
ESU of current	ampere (A)	3.335 6 E−10
ESU of electric potential	volt (V)	2.997 9 E+02
ESU of inductance	henry (H)	8.987 554 E+11
ESU of resistance	ohm (Ω)	8.987 554 E+11
erg	joule (J)	1.000 000* E−07
erg/(cm^2·s)	watt per square metre (W/m^2)	1.000 000* E−03
erg/s	watt (W)	1.000 000* E−07
faraday (based on carbon-12)	coulomb (C)	9.648 70 E+04
faraday (chemical)	coulomb (C)	9.649 57 E+04
faraday (physical)	coulomb (C)	9.652 19 E+04
fathom[13]	metre (m)	1.828 804 E+00
fermi (femtometre)	metre (m)	1.000 000* E−15
fluid ounce (U.S.)	cubic metre (m^3)	2.957 353 E−05
foot	metre (m)	3.048 000* E−01
foot (U.S. survey)[13]	metre (m)	3.048 006 E−01
foot of water (39.2°F)	pascal (Pa)	2.988 98 E+03
ft^2	square metre (m^2)	9.290 304* E−02
ft^2/h (thermal diffusivity)	square metre per second (m^2/s)	2.580 640* E−05
ft^2/s	square metre per second (m^2/s)	9.290 304* E−02
ft^3 (volume; section modulus)	cubic metre (m^3)	2.831 685 E−02
ft^3/min	cubic metre per second (m^3/s)	4.719 474 E−04
ft^3/s	cubic metre per second (m^3/s)	2.831 685 E−02
ft^4 (second moment of area)[18]	metre to the fourth power (m^4)	8.630 975 E−03
ft/h	metre per second (m/s)	8.466 667 E−05
ft/min	metre per second (m/s)	5.080 000* E−03
ft/s	metre per second (m/s)	3.048 000* E−01
ft/s^2	metre per second squared (m/s^2)	3.048 000* E−01
footcandle	lux (lx)	1.076 391 E+01
footlambert	candela per square metre (cd/m^2)	3.426 259 E+00
ft·lbf	joule (J)	1.355 818 E+00
ft·lbf/h	watt (W)	3.766 161 E−04
ft·lbf/min	watt (W)	2.259 697 E−02
ft·lbf/s	watt (W)	1.355 818 E+00
ft-poundal	joule (J)	4.214 011 E−02
g, standard free fall	metre per second squared (m/s^2)	9.806 650* E+00

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[17] In ISO 31 this quantity is called *thermal insulance* and the quantity *thermal resistance* has the unit K/W.

[18] This is sometimes called the moment of section or area moment of inertia of a plane section about a specified axis.

To convert from	to	Multiply by
gal	metre per second squared (m/s^2)	1.000 000*E-02
gallon (Canadian liquid)	cubic metre (m^3)	4.546 090 E-03
gallon (U.K. liquid)	cubic metre (m^3)	4.546 092 E-03
gallon (U.S. dry)	cubic metre (m^3)	4.404 884 E-03
gallon (U.S. liquid)	cubic metre (m^3)	3.785 412 E-03
gallon (U.S. liquid) per day	cubic metre per second (m^3/s)	4.381 264 E-08
gallon (U.S. liquid) per minute	cubic metre per second (m^3/s)	6.309 020 E-05
gallon (U.S. liquid) per hp·h (SFC, specific fuel consumption)	cubic metre per joule (m^3/J)	1.410 089 E-09
gamma	tesla (T)	1.000 000*E-09
gauss	tesla (T)	1.000 000*E-04
gilbert	ampere (A)	7.957 747 E-01
gill (U.K.)	cubic metre (m^3)	1.420 653 E-04
gill (U.S.)	cubic metre (m^3)	1.182 941 E-04
grade	degree (angular)	9.000 000*E-01
grade	radian (rad)	1.570 796 E-02
grain	kilogram (kg)	6.479 891*E-05
grain/gal (U.S. liquid)	kilogram per cubic metre (kg/m^3)	1.711 806 E-02
gram	kilogram (kg)	1.000 000*E-03
g/cm^3	kilogram per cubic metre (kg/m^3)	1.000 000*E+03
gf/cm^2	pascal (Pa)	9.806 650*E+01
hectare	square metre (m^2)	1.000 000*E+04
horsepower (550 ft·lbf/s)	watt (W)	7.456 999 E+02
horsepower (boiler)	watt (W)	9.809 50 E+03
horsepower (electric)	watt (W)	7.460 000*E+02
horsepower (metric)	watt (W)	7.354 99 E+02
horsepower (water)	watt (W)	7.460 43 E+02
horsepower (U.K.)	watt (W)	7.457 0 E+02
hour	second(s)	3.600 000*E+03
hour (sidereal)	second (s)	3.590 170 E+03
hundredweight (long)	kilogram (kg)	5.080 235 E+01
hundredweight (short)	kilogram (kg)	4.535 924 E+01
inch	metre (m)	2.540 000*E-02
inch of mercury (32°F)	pascal (Pa)	3.386 38 E+03
inch of mercury (60°F)	pascal (Pa)	3.376 85 E+03
inch of water (39.2°F)	pascal (Pa)	2.490 82 E+02
inch of water (60°F)	pascal (Pa)	2.488 4 E+02
in^2	square metre (m^2)	6.451 600*E-04
in^3 (volume)[19]	cubic metre (m^3)	1.638 706 E-05
in^3 (section modulus)[19]	metre cubed (m^3)	1.638 706 E-05
in^3/min	cubic metre per second (m^3/s)	2.731 177 E-07
in^4 (second moment of area)[19]	metre to the fourth power (m^4)	4.162 314 E-07
in/s	metre per second (m/s)	2.540 000*E-02
in/s^2	metre per second squared (m/s^2)	2.540 000*E-02
kayser	1 per metre (1/m)	1.000 000*E+02
kelvin	degree Celsius (°C)	$t_{°C} = T_K - 273.15$
kilocalorie (International Table)	joule (J)	4.186 800*E+03
kilocalorie (mean)	joule (J)	4.190 02 E+03
kilocalorie (thermochemical)	joule (J)	4.184 000*E+03
kilocalorie (thermochemical)/min	watt (W)	6.973 333 E+01
kilocalorie (thermochemical)/s	watt (W)	4.184 000*E+03
kilogram-force (kgf)	newton (N)	9.806 650*E+00
kgf·m	newton metre (N·m)	9.806 650*E+00
kgf·s^2/m (mass)	kilogram (kg)	9.806 650*E+00
kgf/cm^2	pascal (Pa)	9.806 650*E+04
kgf/m^2	pascal (Pa)	9.806 650*E+00
kgf/mm^2	pascal (Pa)	9.806 650*E+06
km/h	metre per second (m/s)	2.777 778 E-01
kilopond (1 kp = 1 kgf)	newton (N)	9.806 650*E+00
kW·h	joule (J)	3.600 000*E+06
kip (1000 lbf)	newton (N)	4.448 222 E+03
kip/in^2 (ksi)	pascal (Pa)	6.894 757 E+06

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[19] The exact conversion factor is 1.638 706 4*E-05.

To convert from	to	Multiply by
knot (international)	metre per second (m/s)	5.144 444 E−01
lambert	candela per square metre (cd/m^2)	1/π *E+04
lambert	candela per square metre (cd/m^2)	3.183 099 E+03
langley	joule per square metre (J/m^2)	4.184 000*E+04
light year	metre (m)	9.460 55 E+15
litre[20]	cubic metre (m^3)	1.000 000*E−03
lm/ft^2	lumen per square metre (lm/m^2)	1.076 391 E+01
maxwell	weber (Wb)	1.000 000*E−08
mho	siemens (S)	1.000 000*E+00
microinch	metre (m)	2.540 000*E−08
micron (deprecated term, use micrometre)	metre (m)	1.000 000*E−06
mil	metre (m)	2.540 000*E−05
mile (international)	metre (m)	1.609 344*E+03
mile (U.S. statute)[13]	metre (m)	1.609 347 E+03
mile (international nautical)	metre (m)	1.852 000*E+03
mile (U.S. nautical)	metre (m)	1.852 000*E+03
mi^2 (international)	square metre (m^2)	2.589 988 E+06
mi^2 (U. S. statute)[13]	square metre (m^2)	2.589 998 E+06
mi/h (international)	metre per second (m/s)	4.470 400*E−01
mi/h (international)	kilometre per hour (km/h)	1.609 344*E+00
mi/min (international)	metre per second (m/s)	2.682 240*E+01
mi/s (international)	metre per second (m/s)	1.609 344*E+03
millibar	pascal (Pa)	1.000 000*E+02
millimetre of mercury (0°C)	pascal (Pa)	1.333 22 E+02
minute (angle)	radian (rad)	2.908 882 E−04
minute	second (s)	6.000 000*E+01
minute (sidereal)	second (s)	5.983 617 E+01
oersted	ampere per metre (A/m)	7.957 747 E+01
ohm centimetre	ohm meter (Ω·m)	1.000 000*E−02
ohm circular-mil per foot	ohm metre (Ω·m)	1.662 426 E−09
ounce (avoirdupois)	kilogram (kg)	2.834 952 E−02
ounce (troy or apothecary)	kilogram (kg)	3.110 348 E−02
ounce (U.K. fluid)	cubic metre (m^3)	2.841 306 E−05
ounce (U.S. fluid)	cubic metre (m^3)	2.957 353 E−05
ounce-force	newton (N)	2.780 139 E−01
ozf·in	newton metre (N·m)	7.061 552 E−03
oz (avoirdupois)/gal (U.K. liquid)	kilogram per cubic metre (kg/m^3)	6.236 023 E+00
oz (avoirdupois)/gal (U.S. liquid)	kilogram per cubic metre (kg/m^3)	7.489 152 E+00
oz (avoirdupois)/in^3	kilogram per cubic metre (kg/m^3)	1.729 994 E+03
oz (avoirdupois)/ft^2	kilogram per square metre (kg/m^2)	3.051 517 E−01
oz (avoirdupois)/yd^2	kilogram per square metre (kg/m^2)	3.390 575 E−02
parsec	metre (m)	3.085 678 E+16
peck (U.S.)	cubic metre (m^3)	8.809 768 E−03
pennyweight	kilogram (kg)	1.555 174 E−03
perm (0°C)	kilogram per pascal second square metre [kg/(Pa·s·m^2)]	5.721 35 E−11
perm (23°C)	kilogram per pascal second square metre [kg/(Pa·s·m^2)]	5.745 25 E−11
perm·in (0°C)	kilogram per pascal second metre [kg/(Pa·s·m)]	1.453 22 E−12
perm·in (23°C)	kilogram per pascal second metre [kg/(Pa·s·m)]	1.459 29 E−12
phot	lumen per square metre (lm/m^2)	1.000 000*E+04
pica (printer's)	metre (m)	4.217 518 E−03
pint (U.S. dry)	cubic metre (m^3)	5.506 105 E−04
pint (U.S. liquid)	cubic metre (m^3)	4.731 765 E−04
point (printer's)	metre (m)	3.514 598*E−04
poise (absolute viscosity)	pascal second (Pa·s)	1.000 000*E−01
pound (lb avoirdupois)[21]	kilogram (kg)	4.535 924 E−01

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[20] In 1964 the General Conference on Weights and Measures reestablished the name litre as a special name for the cubic decimetre. Between 1901 and 1964 the litre was slightly larger (1.000 028 dm^3); in the use of high-accuracy volume data of that time interval, this fact must be kept in mind.

[21] The exact conversion factor is 4.535 923 7*E-01.

To convert from	to	Multiply by
pound (troy or apothecary)	kilogram (kg)	3.732 417 E−01
lb·ft^2 (moment of inertia)	kilogram square metre (kg·m^2)	4.214 011 E−02
lb·in^2 (moment of inertia)	kilogram square metre (kg·m^2)	2.926 397 E−04
lb/ft·h	pascal second (Pa·s)	4.133 789 E−04
lb/ft·s	pascal second (Pa·s)	1.488 164 E+00
lb/ft^2	kilogram per square metre (kg/m^2)	4.882 428 E+00
lb/ft^3	kilogram per cubic metre (kg/m^3)	1.601 846 E+01
lb/gal (U.K. liquid)	kilogram per cubic metre (kg/m^3)	9.977 637 E+01
lb/gal (U.S. liquid)	kilogram per cubic metre (kg/m^3)	1.198 264 E+02
lb/h	kilogram per second (kg/s)	1.259 979 E−04
lb/hp·h (SFC, specific fuel consumption)	kilogram per joule (kg/J)	1.689 659 E−07
lb/in^3	kilogram per cubic metre (kg/m^3)	2.767 990 E+04
lb/min	kilogram per second (kg/s)	7.559 873 E−03
lb/s	kilogram per second (kg/s)	4.535 924 E−01
lb/yd^3	kilogram per cubic metre (kg/m^3)	5.932 764 E−01
poundal	newton (N)	1.382 550 E−01
poundal/ft^2	pascal (Pa)	1.488 164 E+00
poundal·s/ft^2	pascal second (Pa·s)	1.488 164 E+00
pound-force (lbf)[22]	newton (N)	4.448 222 E+00
lbf·ft	newton metre (N·m)	1.355 818 E+00
lbf·ft/in	newton metre per metre (N·m/m)	5.337 866 E+01
lbf·in	newton metre (N·m)	1.129 848 E−01
lbf·in/in	newton metre per metre (N·m/m)	4.448 222 E+00
lbf·s/ft^2	pascal second (Pa·s)	4.788 026 E+01
lbf·s/in^2	pascal second (Pa·s)	6.894 757 E+03
lbf/ft	newton per metre (N/m)	1.459 390 E+01
lbf/ft^2	pascal (Pa)	4.788 026 E+01
lbf/in	newton per metre (N/m)	1.751 268 E+02
lbf/in^2 (psi)	pascal (Pa)	6.894 757 E+03
lbf/lb (thrust/weight [mass] ratio)	newton per kilogram (N/kg)	9.806 650 E+00
quart (U.S. dry)	cubic metre (m^3)	1.101 221 E−03
quart (U.S. liquid)	cubic metre (m^3)	9.463 529 E−04
rad (absorbed dose)	gray (Gy)	1.000 000* E−02
rem (dose equivalent)	sievert (Sv)	1.000 000* E−02
rhe	1 per pascal second [1/(Pa·s)]	1.000 000* E+01
rod[11]	metre (m)	5.029 210 E+00
roentgen	coulomb per kilogram (C/kg)	2.58 000* E−04
rpm (r/min)	radian per second (rad/s)	1.047 198 E−01
second (angle)	radian (rad)	4.848 137 E−06
second (sidereal)	second (s)	9.972 696 E−01
shake	second (s)	1.000 000* E−08
slug	kilogram (kg)	1.459 390 E+01
slug/ft·s	pascal second (Pa·s)	4.788 026 E+01
slug/ft^3	kilogram per cubic metre (kg/m^3)	5.153 788 E+02
statampere	ampere (A)	3.335 640 E−10
statcoulomb	coulomb (C)	3.335 640 E−10
statfarad	farad (F)	1.112 650 E−12
stathenry	henry (H)	8.987 554 E+11
statmho	siemens (S)	1.112 650 E−12
statohm	ohm (Ω)	8.987 554 E+11
statvolt	volt (V)	2.997 925 E+02
stere	cubic metre (m^3)	1.000 000* E+00
stilb	candela per square metre (cd/m^2)	1.000 000* E+04
stokes (kinematic viscosity)	square metre per second (m^2/s)	1.000 000* E−04
tablespoon	cubic metre (m^3)	1.478 676 E−05
teaspoon	cubic metre (m^3)	4.928 922 E−06
tex	kilogram per metre (kg/m)	1.000 000* E−06
therm (European Community)[23]	joule (J)	1.055 06 E+08
therm (U.S.)[23]	joule (J)	1.054 804* E+08

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[22] The exact conversion factor is 4.448 221 615 260 5*E+00.

[23] The therm (European Community) is legally defined in the Council of the European Communities Directive 80/181/EC of December 20, 1979. The therm (U.S.) is legally defined in the *Federal Register*, Vol 33, No. 146, p. 10756, of July 27, 1968. Although the European therm, which is based on the International Table Btu, is frequently used by engineers in the U.S., the therm (U.S.) is the legal unit used by the U.S. natural gas industry.

To convert from	to	Multiply by
ton (assay)	kilogram (kg)	2.916 667 E−02
ton (long, 2240 lb)	kilogram (kg)	1.016 047 E+03
ton (metric)	kilogram (kg)	1.000 000*E+03
ton (nuclear equivalent of TNT)	joule (J)	4.184 E+09[24]
ton of refrigeration (= 12 000 Btu/h)	watt (W)	3.517 E+03
ton (register)	cubic metre (m^3)	2.831 685 E+00
ton (short, 2000 lb)	kilogram (kg)	9.071 847 E+02
ton (long)/yd^3	kilogram per cubic metre (kg/m^3)	1.328 939 E+03
ton (short)/yd^3	kilogram per cubic metre (kg/m^3)	1.186 553 E+03
ton (short)/h	kilogram per second (kg/s)	2.519 958 E−01
ton-force (2000 lbf)	newton (N)	8.896 443 E+03
tonne	kilogram (kg)	1.000 000*E+03
torr (mmHg, 0°C)	pascal (Pa)	1.333 22 E+02
unit pole	weber (Wb)	1.256 637 E−07
W·h	joule (J)	3.600 000*E+03
W·s	joule (J)	1.000 000*E+00
W/cm^2	watt per square metre (W/m^2)	1.000 000*E+04
W/in^2	watt per square metre (W/m^2)	1.550 003 E+03
yard	metre (m)	9.144 000*E−01
yd^2	square metre (m^2)	8.361 274 E−01
yd^3	cubic metre (m^3)	7.645 549 E−01
yd^3/min	cubic metre per second (m^3/s)	1.274 258 E−02
year (365 days)	second (s)	3.153 600*E+07
year (sidereal)	second (s)	3.155 815 E+07
year (tropical)	second (s)	3.155 693 E+07

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[24] Defined (not measured) value

CLASSIFIED LIST OF UNITS

To convert from	to	Multiply by
	ACCELERATION	
ft/s^2	metre per second squared (m/s^2)	3.048 000*E−01
free fall, standard (*g*)	metre per second squared (m/s^2)	9.806 650*E+00
gal	metre per second squared (m/s^2)	1.000 000*E−02
in/s^2	metre per second squared (m/s^2)	2.540 000*E−02
	ANGLE	
degree	radian (rad)	1.745 329 E−02
minute	radian (rad)	2.908 882 E−04
second	radian (rad)	4.848 137 E−06
grade	degree (angular)	9.000 000*E−01
grade	radian (rad)	1.570 796 E−02
	AREA	
acre[13]	square metre (m^2)	4.046 873 E+03
are	square metre (m^2)	1.000 000*E+02
barn	square metre (m^2)	1.000 000*E−28
circular mil	square metre (m^2)	5.067 075 E−10
darcy[14]	square metre (m^2)	9.869 233 E−13
ft^2	square metre (m^2)	9.290 304*E−02
hectare	square metre (m^2)	1.000 000*E+04
in^2	square metre (m^2)	6.451 600*E−04
mi^2 (international)	square metre (m^2)	2.589 988 E+06
mi^2 (U.S. statute)[13]	square metre (m^2)	2.589 998 E+06
yd^2	square metre (m^2)	8.361 274 E−01
	BENDING MOMENT OR TORQUE (see 3.4.4)	
dyne·cm	newton metre (N·m)	1.000 000*E−07
kgf·m	newton metre (N·m)	9.806 650*E+00
ozf·in	newton metre (N·m)	7.061 552 E−03
lbf·in	newton metre (N·m)	1.129 848 E−01
lbf·ft	newton metre (N·m)	1.355 818 E+00
	BENDING MOMENT OR TORQUE PER UNIT LENGTH	
lbf·ft/in	newton metre per metre (N·m/m)	5.337 866 E+01
lbf·in/in	newton metre per metre (N·m/m)	4.448 222 E+00
	CAPACITY (See VOLUME)	
	DENSITY (See MASS PER UNIT VOLUME)	
	ELECTRICITY AND MAGNETISM[20]	
abampere	ampere (A)	1.000 000*E+01
abcoulomb	coulomb (C)	1.000 000*E+01
abfarad	farad (F)	1.000 000*E+09
abhenry	henry (H)	1.000 000*E−09
abmho	siemens (S)	1.000 000*E+09
abohm	ohm (Ω)	1.000 000*E−09

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[20] ESU means electrostatic cgs unit. EMU means electromagnetic cgs unit.

To convert from	to	Multiply by
abvolt	volt (V)	1.000 000*E−08
ampere hour	coulomb (C)	3.600 000*E+03
EMU of capacitance	farad (F)	1.000 000*E+09
EMU of current	ampere (A)	1.000 000*E+01
EMU of electric potential	volt (V)	1.000 000*E−08
EMU of inductance	henry (H)	1.000 000*E−09
EMU of resistance	ohm (Ω)	1.000 000*E−09
ESU of capacitance	farad (F)	1.112 650 E−12
ESU of current	ampere (A)	3.335 6 E−10
ESU of electric potential	volt (V)	2.997 9 E+02
ESU of inductance	henry (H)	8.987 554 E+11
ESU of resistance	ohm (Ω)	8.987 554 E+11
faraday (based on carbon-12)	coulomb (C)	9.648 70 E+04
faraday (chemical)	coulomb (C)	9.649 57 E+04
faraday (physical)	coulomb (C)	9.652 19 E+04
gamma	tesla (T)	1.000 000*E−09
gauss	tesla (T)	1.000 000*E−04
gilbert	ampere (A)	7.957 747 E−01
maxwell	weber (Wb)	1.000 000*E−08
mho	siemens (S)	1.000 000*E+00
oersted	ampere per metre (A/m)	7.957 747 E+01
ohm centimetre	ohm metre (Ω·m)	1.000 000*E−02
ohm circular-mil per foot	ohm metre (Ω·m)	1.662 426 E−09
statampere	ampere (A)	3.335 640 E−10
statcoulomb	coulomb (C)	3.335 640 E−10
statfarad	farad (F)	1.112 650 E−12
stathenry	henry (H)	8.987 554 E+11
statmho	siemens (S)	1.112 650 E−12
statohm	ohm (Ω)	8.987 554 E+11
statvolt	volt (V)	2.997 925 E+02
unit pole	weber (Wb)	1.256 637 E−07

Energy (Includes Work)

To convert from	to	Multiply by
British thermal unit (International Table)[14]	joule (J)	1.055 056 E+03
British thermal unit (mean)	joule (J)	1.055 87 E+03
British thermal unit (thermochemical)	joule (J)	1.054 350 E+03
British thermal unit (39°F)	joule (J)	1.059 67 E+03
British thermal unit (59°F)	joule (J)	1.054 80 E+03
British thermal unit (60°F)	joule (J)	1.054 68 E+03
calorie (International Table)	joule (J)	4.186 800*E+00
calorie (mean)	joule (J)	4.190 02 E+00
calorie (thermochemical)	joule (J)	4.184 000*E+00
calorie (15°C)	joule (J)	4.185 80 E+00
calorie (20°C)	joule (J)	4.181 90 E+00
calorie (kilogram, International Table)	joule (J)	4.186 800*E+03
calorie (kilogram, mean)	joule (J)	4.190 02 E+03
calorie (kilogram, thermochemical)	joule (J)	4.184 000*E+03
electronvolt	joule (J)	1.602 19 E−19
erg	joule (J)	1.000 000*E−07
ft·lbf	joule (J)	1.355 818 E+00
ft-poundal	joule (J)	4.214 011 E−02
kilocalorie (International Table)	joule (J)	4.186 800*E+03
kilocalorie (mean)	joule (J)	4.190 02 E+03
kilocalorie (thermochemical)	joule (J)	4.184 000*E+03
kW·h	joule (J)	3.600 000*E+06
therm (European Community)[23]	joule (J)	1.055 06 E+08
therm (U.S.)[23]	joule (J)	1.054 804*E+08
ton (nuclear equivalent of TNT)	joule (J)	4.184 E+09[24]
W·h	joule (J)	3.600 000*E+03
W·s	joule (J)	1.000 000*E+00

To convert from	to	Multiply by
	ENERGY PER UNIT AREA TIME	
Btu (International Table)/($ft^2 \cdot s$)	watt per square metre (W/m^2)	1.135 653 E+04
Btu (International Table)/($ft^2 \cdot h$)	watt per square metre (W/m^2)	3.154 591 E+00
Btu (thermochemical)/($ft^2 \cdot s$)	watt per square metre (W/m^2)	1.134 893 E+04
Btu (thermochemical)/($ft^2 \cdot min$)	watt per square metre (W/m^2)	1.891 489 E+02
Btu (thermochemical)/($ft^2 \cdot h$)	watt per square metre (W/m^2)	3.152 481 E+00
Btu (thermochemical)/($in^2 \cdot s$)	watt per square metre (W/m^2)	1.634 246 E+06
cal (thermochemical)/($cm^2 \cdot min$)	watt per square metre (W/m^2)	6.973 333 E+02
cal (thermochemical)/($cm^2 \cdot s$)	watt per square metre (W/m^2)	4.184 000*E+04
erg/($cm^2 \cdot s$)	watt per square metre (W/m^2)	1.000 000*E−03
W/cm^2	watt per square metre (W/m^2)	1.000 000*E+04
W/in^2	watt per square metre (W/m^2)	1.550 003 E+03
	FLOW (See MASS PER UNIT TIME or VOLUME PER UNIT TIME)	
	FORCE	
dyne	newton (N)	1.000 000*E−05
kilogram-force	newton (N)	9.806 650*E+00
kilopond (kp)	newton (N)	9.806 650*E+00
kip (1000 lbf)	newton (N)	4.448 222 E+03
ounce-force	newton (N)	2.780 139 E−01
pound-force (lbf)[17]	newton (N)	4.448 222 E+00
lbf/lb (thrust/weight [mass] ratio)	newton per kilogram (N/kg)	9.806 650 E+00
poundal	newton (N)	1.382 550 E−01
ton-force (2000 lbf)	newton (N)	8.896 443 E+03
	FORCE PER UNIT AREA (See PRESSURE)	
	FORCE PER UNIT LENGTH	
lbf/ft	newton per metre (N/m)	1.459 390 E+01
lbf/in	newton per metre (N/m)	1.751 268 E+02
	HEAT	
Btu (International Table)·ft/($h \cdot ft^2 \cdot °F$) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.730 735 E+00
Btu (thermochemical)·ft/($h \cdot ft^2 \cdot °F$) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.729 577 E+00
Btu (International Table)·in/($h \cdot ft^2 \cdot °F$) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.442 279 E−01
Btu (thermochemical)·in($h \cdot ft^2 \cdot °F$) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.441 314 E−01
Btu (International Table)·in/($s \cdot ft^2 \cdot °F$) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	5.192 204 E+02
Btu (thermochemical)·in/($s \cdot ft^2 \cdot °F$) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	5.188 732 E+02
Btu (International Table)/ft^2	joule per square metre (J/m^2)	1.135 653 E+04
Btu (thermochemical)/ft^2	joule per square metre (J/m^2)	1.134 893 E+04
Btu (International Table)/($h \cdot ft^2 \cdot °F$) (thermal conductance)[18]	watt per square metre kelvin [W/($m^2 \cdot K$)]	5.678 263 E+00
Btu (thermochemical)/($h \cdot ft^2 \cdot °F$)(thermal conductance)[18]	watt per square metre kelvin [W/($m^2 \cdot K$)]	5.674 466 E+00
Btu (International Table)/($s \cdot ft^2 \cdot °F$)	watt per square metre kelvin [W/($m^2 \cdot K$)]	2.044 175 E+04
Btu (thermochemical)/($s \cdot ft^2 \cdot °F$)	watt per square metre kelvin [W/($m^2 \cdot K$)]	2.042 808 E+04
Btu (International Table)/lb	joule per kilogram (J/kg)	2.326 000*E+03
Btu (thermochemical)/lb	joule per kilogram (J/kg)	2.324 444 E+03
Btu (International Table)/(lb·°F) (heat capacity)	joule per kilogram kelvin [J/(kg·K)]	4.186 800*E+03
Btu (thermochemical)/(lb·°F) (heat capacity)	joule per kilogram kelvin [J/(kg·K)]	4.184 000*E+03

To convert from	to	Multiply by
Btu (International Table)/ft^3	joule per cubic metre (J/m^3)	3.725 895 E+04
Btu (thermochemical)/ft^3	joule per cubic metre (J/m^3)	3.723 402 E+04
cal (thermochemical)/(cm·s·°C)	watt per metre kelvin [(W/(m·K)]	4.184 000*E+02
cal (thermochemical)/cm^2	joule per square metre (J/m^2)	4.184 000*E+04
cal (thermochemical)/(cm^2·min)	watt per square metre (W/m^2)	6.973 333 E+02
cal (thermochemical)/(cm^2·s)	watt per square metre (W/m^2)	4.184 000*E+04
cal (International Table)/g	joule per kilogram (J/kg)	4.186 800*E+03
cal (thermochemical)/g	joule per kilogram (J/kg)	4.184 000*E+03
cal (International Table)/(g·°C)	joule per kilogram kelvin [(J/kg·K)]	4.186 800*E+03
cal (thermochemical)/(g·°C)	joule per kilogram kelvin [(J/(kg·K)]	4.184 000*E+03
cal (thermochemical)/min	watt (W)	6.973 333 E−02
cal (thermochemical)/s	watt (W)	4.184 000*E+00
clo	kelvin square metre per watt (K·m^2/W)	1.55 E−01
°F·h·ft^2/Btu (International Table) (thermal resistance)[17]	kelvin square metre per watt (K·m^2/W)	1.761 102 E−01
°F·h·ft^2/Btu (thermochemical) (thermal resistance)[17]	kelvin square metre per watt (K·m^2/W)	1.762 280 E−01
°F·h·ft^2/[Btu (International Table)·in] (thermal resistivity)	kelvin metre per watt (K·m/W)	6.933 471 E+00
°F·h·ft^2/[Btu (thermochemical)·in](thermal resistivity)	kelvin metre per watt (K·m/W)	6.938 113 E+00
ft^2/h (thermal diffusivity)	square metre per second (m^2/s)	2.580 640*E−05
	LENGTH	
angstrom	metre (m)	1.000 000*E−10
astronomical unit	metre (m)	1.495 979 E+11
chain[13]	metre (m)	2.011 684 E+01
fathom[13]	metre (m)	1.828 804 E+00
fermi (femtometre)	metre (m)	1.000 000*E−15
foot	metre (m)	3.048 000*E−01
foot (U.S. survey)[13]	metre (m)	3.048 006 E−01
inch	metre (m)	2.540 000*E−02
light year	metre (m)	9.460 55 E+15
microinch	metre (m)	2.540 000*E−08
micron (deprecated term, use micrometre)	metre (m)	1.000 000*E−06
mil	metre (m)	2.540 000*E−05
mile (international nautical)	metre (m)	1.852 000*E+03
mile (U.S. nautical)	metre (m)	1.852 000*E+03
mile (international)	metre (m)	1.609 344*E+03
mile (U.S. statute)[13]	metre (m)	1.609 347 E+03
parsec	metre (m)	3.085 678 E+16
pica (printer's)	metre (m)	4.217 518 E−03
point (printer's)	metre (m)	3.514 598*E−04
rod[13]	metre (m)	5.029 210 E+00
yard	metre (m)	9.144 000*E−01
	LIGHT	
cd/in^2	candela per square metre (cd/m^2)	1.550 003 E+03
footcandle	lux (lx)	1.076 391 E+01
footlambert	candela per square metre (cd/m^2)	3.426 259 E+00
lambert	candela per square metre (cd/m^2)	3.183 099 E+03
lm/ft^2	lumen per square metre (lm/m^2)	1.076 391 E+01
	MASS	
carat (metric)	kilogram (kg)	2.000 000*E−04
grain	kilogram (kg)	6.479 891*E−05
gram	kilogram (kg)	1.000 000*E−03
hundredweight (long)	kilogram (kg)	5.080 235 E+01
hundredweight (short)	kilogram (kg)	4.535 924 E+01

To convert from	to	Multiply by
kgf·s^2/m (mass)	kilogram (kg)	9.806 650*E+00
ounce (avoirdupois)	kilogram (kg)	2.834 952 E−02
ounce (troy or apothecary)	kilogram (kg)	3.110 348 E−02
pennyweight	kilogram (kg)	1.555 174 E−03
pound (lb avoirdupois)[21]	kilogram (kg)	4.535 924 E−01
pound (troy or apothecary)	kilogram (kg)	3.732 417 E−01
slug	kilogram (kg)	1.459 390 E+01
ton (assay)	kilogram (kg)	2.916 667 E−02
ton (long, 2240 lb)	kilogram (kg)	1.016 047 E+03
ton (metric)	kilogram (kg)	1.000 000*E+03
ton (short, 2000 lb)	kilogram (kg)	9.071 847 E+02
tonne	kilogram (kg)	1.000 000*E+03
	MASS PER UNIT AREA	
oz/ft^2	kilogram per square metre (kg/m^2)	3.051 517 E−01
oz/yd^2	kilogram per square metre (kg/m^2)	3.390 575 E−02
lb/ft^2	kilogram per square metre (kg/m^2)	4.882 428 E+00
	MASS PER UNIT CAPACITY (See MASS PER UNIT VOLUME)	
	MASS PER UNIT LENGTH	
denier	kilogram per metre (kg/m)	1.111 111 E−07
lb/ft	kilogram per metre (kg/m)	1.488 164 E+00
lb/in	kilogram per metre (kg/m)	1.785 797 E+01
tex	kilogram per metre (kg/m)	1.000 000*E−06
	MASS PER UNIT TIME (Includes FLOW)	
perm (0°C)	kilogram per pascal second square metre [kg/(Pa·s·m^2)]	5.721 35 E−11
perm (23°C)	kilogram per pascal second square metre [kg/(Pa·s·m^2)]	5.745 25 E−11
perm·in (0°C)	kilogram per pascal second metre [kg/(Pa·s·m)]	1.453 22 E−12
perm·in (23°C)	kilogram per pascal second metre [kg/(Pa·s·m)]	1.459 29 E−12
lb/h	kilogram per second (kg/s)	1.259 979 E−04
lb/min	kilogram per second (kg/s)	7.559 873 E−03
lb/s	kilogram per second (kg/s)	4.535 924 E−01
lb/(hp·h) (SFC, specific fuel consumption)	kilogram per joule (kg/J)	1.689 659 E−07
ton (short)/h	kilogram per second (kg/s)	2.519 958 E−01
	MASS PER UNIT VOLUME (Includes DENSITY and MASS CAPACITY)	
grain/gal (U.S. liquid)	kilogram per cubic metre (kg/m^3)	1.711 806 E−02
g/cm^3	kilogram per cubic metre (kg/m^3)	1.000 000*E+03
oz (avoirdupois)/gal (U.K. liquid)	kilogram per cubic metre (kg/m^3)	6.236 023 E+00
oz (avoirdupois)/gal (U.S. liquid)	kilogram per cubic metre (kg/m^3)	7.489 152 E+00
oz (avoirdupois)/in^3	kilogram per cubic metre (kg/m^3)	1.729 994 E+03
lb/ft^3	kilogram per cubic metre (kg/m^3)	1.601 846 E+01
lb/in^3	kilogram per cubic metre (kg/m^3)	2.767 990 E+04
lb/gal (U.K. liquid)	kilogram per cubic metre (kg/m^3)	9.977 637 E+01
lb/gal (U.S. liquid)	kilogram per cubic metre (kg/m^3)	1.198 264 E+02
lb/yd^3	kilogram per cubic metre (kg/m^3)	5.932 764 E−01
slug/ft^3	kilogram per cubic metre (kg/m^3)	5.153 788 E+02
ton (long)/yd^3	kilogram per cubic metre (kg/m^3)	1.328 939 E+03
ton (short)/yd^3	kilogram per cubic metre (kg/m^3)	1.186 553 E+03
	POWER	
Btu (International Table)/h	watt (W)	2.930 711 E−01

To convert from	to	Multiply by
Btu (International Table)/s	watt (W)	1.055 056 E+03
Btu (thermochemical)/h	watt (W)	2.928 751 E−01
Btu (thermochemical)/min	watt (W)	1.757 250 E+01
Btu (thermochemical)/s	watt (W)	1.054 350 E+03
cal (thermochemical)/min	watt (W)	6.973 333 E−02
cal (thermochemical)/s	watt (W)	4.184 000*E+00
erg/s	watt (W)	1.000 000*E−07
ft·lbf/h	watt (W)	3.766 161 E−04
ft·lbf/min	watt (W)	2.259 697 E−02
ft·lbf/s	watt (W)	1.355 818 E+00
horsepower (550 ft·lbf/s)	watt (W)	7.456 999 E+02
horsepower (boiler)	watt (W)	9.809 50 E+03
horsepower (electric)	watt (W)	7.460 000*E+02
horsepower (metric)	watt (W)	7.354 99 E+02
horsepower (water)	watt (W)	7.460 43 E+02
horsepower (U.K.)	watt (W)	7.457 0 E+02
kilocalorie (thermochemical)/min	watt (W)	6.973 333 E+01
kilocalorie (thermochemical)/s	watt (W)	4.184 000*E+03
ton of refrigeration (= 12 000 Btu/h)	watt (W)	3.517 E+03

PRESSURE OR STRESS (FORCE PER UNIT AREA)

To convert from	to	Multiply by
atmosphere, standard	pascal (Pa)	1.013 250*E+05
atmosphere, technical (= 1 kgf/cm^2)	pascal (Pa)	9.806 650*E+04
bar	pascal (Pa)	1.000 000*E+05
centimetre of mercury (0°C)	pascal (Pa)	1.333 22 E+03
centimetre of water (4°C)	pascal (Pa)	9.806 38 E+01
dyne/cm^2	pascal (Pa)	1.000 000*E−01
foot of water (39.2°F)	pascal (Pa)	2.988 98 E+03
gf/cm^2	pascal (Pa)	9.806 650*E+01
inch of mercury (32°F)	pascal (Pa)	3.386 38 E+03
inch of mercury (60°F)	pascal (Pa)	3.376 85 E+03
inch of water (39.2°F)	pascal (Pa)	2.490 82 E+02
inch of water (60°F)	pascal (Pa)	2.488 4 E+02
kgf/cm^2	pascal (Pa)	9.806 650*E+04
kgf/m^2	pascal (Pa)	9.806 650*E+00
kgf/mm^2	pascal (Pa)	9.806 650*E+06
kip/in^2 (ksi)	pascal (Pa)	6.894 757 E+06
millibar	pascal (Pa)	1.000 000*E+02
millimetre of mercury (0°C)	pascal (Pa)	1.333 22 E+02
poundal/ft^2	pascal (Pa)	1.488 164 E+00
lbf/ft^2	pascal (Pa)	4.788 026 E+01
lbf/in^2 (psi)	pascal (Pa)	6.894 757 E+03
psi	pascal (Pa)	6.894 757 E+03
torr (mmHg, 0°C)	pascal (Pa)	1.333 22 E+02

RADIATION UNITS

To convert from	to	Multiply by
curie	becquerel (Bq)	3.700 000*E+10
rad	gray (Gy)	1.000 000*E−02
rem	sievert (Sv)	1.000 000*E−02
roentgen	coulomb per kilogram (C/kg)	2.580 000*E−04

SPEED (See VELOCITY)

STRESS (See PRESSURE)

TEMPERATURE

To convert from	to	Multiply by
degree Celsius	kelvin (K)	$T_K = t_C + 273.15$
degree Fahrenheit	degree Celsius (°C)	$t_C = (t_F - 32)/1.8$
degree Fahrenheit	kelvin (K)	$T_K = (t_F + 459.67)/1.8$
degree Rankine	kelvin (K)	$T_K = T_R/1.8$
kelvin	degree Celsius (°C)	$t_C = T_K - 273.15$

To convert from	to	Multiply by
	TIME	
day	second (s)	8.640 000*E+04
day (sidereal)	second (s)	8.616 409 E+04
hour	second (s)	3.600 000*E+03
hour (sidereal)	second (s)	3.590 170 E+03
minute	second (s)	6.000 000*E+01
minute (sidereal)	second (s)	5.983 617 E+01
second (sidereal)	second (s)	9.972 696 E−01
year (365 days)	second (s)	3.153 600*E+07
year (sidereal)	second (s)	3.155 815 E+07
year (tropical)	second (s)	3.155 693 E+07
	TORQUE (See BENDING MOMENT)	
	VELOCITY (Includes SPEED)	
ft/h	metre per second (m/s)	8.466 667 E−05
ft/min	metre per second (m/s)	5.080 000*E−03
ft/s	metre per second (m/s)	3.048 000*E−01
in/s	metre per second (m/s)	2.540 000*E−02
km/h	metre per second (m/s)	2.777 778 E−01
knot (international)	metre per second (m/s)	5.144 444 E−01
mi/h (international)	metre per second (m/s)	4.470 400*E−01
mi/min (international)	metre per second (m/s)	2.682 240*E+01
mi/s (international)	metre per second (m/s)	1.609 344*E+03
mi/h (international)	kilometre per hour (km/h)[28]	1.609 344*E+00
rpm (r/min)	radian per second (rad/s)	1.047 198 E−01
	VISCOSITY	
centipoise (dynamic viscosity)	pascal second (Pa·s)	1.000 000*E−03
centistokes (kinematic viscosity)	square metre per second (m^2/s)	1.000 000*E−06
ft^2/s	square metre per second (m^2/s)	9.290 304*E−02
poise	pascal second (Pa·s)	1.000 000*E−01
poundal·s/ft^2	pascal second (Pa·s)	1.488 164 E+00
lb/(ft·h)	pascal second (Pa·s)	4.133 789 E−04
lb/(ft·s)	pascal second (Pa·s)	1.488 164 E+00
lbf·s/ft^2	pascal second (Pa·s)	4.788 026 E+01
lbf·s/in^2	pascal second (Pa·s)	6.894 757 E+03
rhe	1 per pascal second [1/(Pa·s)]	1.000 000*E+01
slug/(ft·s)	pascal second (Pa·s)	4.789 026 E+01
stokes	square metre per second (m^2/s)	1.000 000*E−04
	VOLUME (Includes CAPACITY)	
acre-foot[17]	cubic metre (m^3)	1.233 489 E+03
barrel (oil, 42 gal)	cubic metre (m^3)	1.589 873 E−01
board foot	cubic metre (m^3)	2.359 737 E−03
bushel (U.S.)	cubic metre (m^3)	3.523 907 E−02
cup	cubic metre (m^3)	2.365 882 E−04
ounce (U.S. fluid)	cubic metre (m^3)	2.957 353 E−05
ft^3	cubic metre (m^3)	2.831 685 E−02
gallon (Canadian liquid)	cubic metre (m^3)	4.546 090 E−03
gallon (U.K. liquid)	cubic metre (m^3)	4.546 092 E−03
gallon (U.S. dry)	cubic metre (m^3)	4.404 884 E−03
gallon (U.S. liquid)	cubic metre (m^3)	3.785 412 E−03
gill (U.K.)	cubic metre (m^3)	1.420 653 E−04
gill (U.S.)	cubic metre (m^3)	1.182 941 E−04
in^3 [see footnote 19]	cubic metre (m^3)	1.638 706 E−05
litre [see footnote 20]	cubic metre (m^3)	1.000 000*E−03
ounce (U.K. fluid)	cubic metre (m^3)	2.841 306 E−05

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[28] Although speedometers may read km/h, the SI unit is m/s.

To convert from	to	Multiply by
ounce (U.S. fluid)	cubic metre (m^3)	2.957 353 E−05
peck (U.S.)	cubic metre (m^3)	8.809 768 E−03
pint (U.S. dry)	cubic metre (m^3)	5.506 105 E−04
pint (U.S. liquid)	cubic metre (m^3)	4.731 765 E−04
quart (U.S. dry)	cubic metre (m^3)	1.101 221 E−03
quart (U.S. liquid)	cubic metre (m^3)	9.463 529 E−04
stere	cubic metre (m^3)	1.000 000*E+00
tablespoon	cubic metre (m^3)	1.478 676 E−05
teaspoon	cubic metre (m^3)	4.928 922 E−06
ton (register)	cubic metre (m^3)	2.831 685 E+00
yd^3	cubic metre (m^3)	7.645 549 E−01

Volume per Unit Time (Includes Flow)

ft^3/min	cubic metre per second (m^3/s)	4.719 474 E−04
ft^3/s	cubic metre per second (m^3/s)	2.831 685 E−02
gallon (U.S. liquid)/(hp·h)(SFC, specific fuel consumption)	cubic metre per joule (m^3/J)	1.410 089 E−09
in^3/min	cubic metre per second (m^3/s)	2.731 177 E−07
yd^3/min	cubic metre per second (m^3/s)	1.274 258 E−02
gallon (U.S. liquid) per day	cubic metre per second (m^3/s)	4.381 264 E−08
gallon (U.S. liquid) per minute	cubic metre per second (m^3/s)	6.309 020 E−05

Work (See Energy)

X4. SUPPLEMENTARY METRIC PRACTICE GUIDES

X4.1 The following Supplementary Metric Practice Guides have been prepared by ASTM technical committees for use with Standard E 380. Each of these guides provides for metric practices specifically related to ASTM standards over which the technical committee has jurisdiction, and each is published in the appropriate part of the *Annual Book of ASTM Standards.*

Committee	Title of Guide	Volume
B-8	Guidelines for Metrication in the Field of Electrodeposition and Related Processes	02.05
C-1	Metric Practice Guide for Cement	04.01
C-9	Metric Practice Guide for Concrete and Concrete Aggregates	04.02
D-8	Abbreviated Metric Practice Guide for the Roofing Industry	04.04
D-13	Suggested SI Units for Textiles	07.01, 07.02
F-2	Guidelines for SI Conversion of Units in the Field of Flexible Barrier Materials	15.09
G-1	Condensed Metric Practice Guide for Corrosion	03.02

X4.2 In certain cases ASTM technical committees have developed supplementary metric practice guides that have been issued as standards, as follows:

Standard	Committee	Title	Volume
E 621	E-6	Practice for Use of Metric (SI) Units in Building Design and Construction (Committee E-6 Supplement to E 380)	04.07
C 899	C-8	Practice for Use of Metric Units of Measure for Reporting Properties of Refractory Materials (Committee C-8 Supplement to E 380)	15.01

BIBLIOGRAPHY

ASTM, 1916 Race St., Philadelphia, Pa. 19103:

(1) Definitions A 340, Terms, Symbols, and Conversion Factors Relating to Magnetic Testing
(2) Method D 2161, Conversion of Kinematic Viscosity to Saybolt Universal Viscosity or to Saybolt Furol Viscosity
(3) Petroleum Measurement Tables D 1250
(4) Rec. Practice E 29, for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values

Canadian Standards Association, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3:[27]

(5) CAN3-Z234.1-79, Canadian Metric Practice Guide

Institute of Electrical and Electronics Engineers, 345 E. 47th St., New York, N.Y. 10017:

(6) ANSI/IEEE Std 260-1978, Letter Symbols for Units of Measurement

International Organization for Standardization, Geneva, Switzerland:[27]

(7) ISO/R370-1964, Conversion of Toleranced Dimensions from Inches into Millimetres and Vice Versa
(8) ISO/31 Quantities and Units of SI:
ISO 31/O-1974 General Introduction to ISO 31—General Principles Concerning Quantities, Units and Symbols
ISO 31/I-1978 Quantities and Units of Space and Time
ISO 31/II-1978 Quantities and Units of Periodic and Related Phenomena
ISO 31/III-1978 Quantities and Units of Mechanics
ISO 31/IV-1978 Quantities and Units of Heat
R31-Part V-1965 Quantities and Units of Electricity and Magnetism
ISO 31/VI-1973 Quantities and Units of Light and Related Electro-Magnetic Radiations
ISO 31/VII-1978 Quantities and Units of Acoustics
ISO 31/VIII-1973 Quantities and Units of Physical Chemistry and Molecular Physics
ISO 31/IX-1973 Quantities and Units of Atomic and Nuclear Physics
ISO 31/X-1973 Quantities and Units of Nuclear Reactions and Ionizing Radiations
ISO 31/XI-1978 Mathematical Signs and Symbols for Use in the Physical Sciences and Technology
ISO 31/XII-1975 Dimensionless Parameters
ISO 31/XIII-1975 Quantities and Units of Solid State Physics
(9) ISO/1000-1981, SI Units and Recommendations for the Use of Their Multiples and of Certain Other Units
(10) ISO/2955-1974, Information Processing—Representations of SI and Other Units for Use in Systems with Limited Character Sets

National Bureau of Standards (documents available free of charge from NBS, Washington, D.C. 20234):

(11) "Units and Systems of Weights and Measures. Their Origin, Development, and Present Status," *NBS Letter Circ. LC 1035*, January 1960, amended January 1976
(12) "NBS Guidelines for the Use of the Modernized Metric System," *NBS LC 1120* (1979)

National Bureau of Standards (documents available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402):

(13) Judson, L V, "Weights and Measures Standards of the United States, a Brief History," *NBS Spec. Publ. 447*, March 1976
(14) Chart—"The Modernized Metric System" *NBS Spec. Publ. 304*, 1981
(15) "The International System of Units (SI)," *NBS Special Publication 330*, 1981

Miscellaneous:

(16) Mechtly, E A, "The International System of Units—Physical Constants and Conversion Factors," National Aeronautics and Space Administration (1973), Publication SP-7012 (1973). Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
(17) McNish, A G, "The International System of Units," *Materials Research and Standards*, Am. Soc. Testing Mats., Vol. 5, No. 10, October 1965.
(18) "Changing to the Metric System, Conversion Factors, Symbols, Definitions," Nat. Physical Lab., Her Majesty's Stationery Office, London, England, 1965
(19) *Metric Standards for Engineering*, British Standard Handbook No. 18 (1972)
(20) Chart—"Quantities and SI Units," Nederlands Normalisatie Instituut, Polakweg 5, Rijswijk (ZH), Netherlands[27]
(21) Hvistendahl, H S, *Engineering Units and Physical Quantities*, Macmillan and Co. Ltd., London, 1964
(22) ANSI X3.50 Representations for U.S. Customary, SI, and Other Units to Be Used in Systems with Limited Character Sets

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[27] Available in the United States from American National Standards Institute (ANSI), 1430 Broadway, New York, N.Y. 10018.

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, Pa. 19103.

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September 14, 1989

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research
and Technology
House Committee on Science, Space
and Technology
Suite 2321
Rayburn House Office Building
Washington, DC 20515

Re: July 25, 1989 Subcommittee hearing concerning international voluntary standards activities and the role of the federal government - additional questions from Congressman Brown

Dear Congressman Walgren:

Your aide, Carol Pompliano, has forwarded to me additional questions posed by Congressman Brown concerning metrication and international standards. The following is my response to the questions:

Question 1 - ANSI has been very instrumental in the support of metrication in the United States. In 1974 ANSI was responsible for the formation of the American National Metric Council and committed over $300,000 in start-up funding. James Pearse, ANSI Chairman of the Board, will speak next month at the National Metric Conference "Measure Up for 92".

ANSI's Style Manual which is used by standards developing organizations requires use of metric for dimensions and quantities. The manual indicates "If SI units are not included in a proposed American National Standard, the subcommittees must inform ANSI why it was not practicable to include them when submitting the standard to ANSI for approval".

Question 2 - It has been ANSI's experience that metrication is more important to some industries than others and the level of interest in metrication varies accordingly. While ANSI has not dedicated a conference to metrication, various speakers at our recent Public Conferences have discussed the metric issue and the need for increased metrication in U.S. standards. In 1988 Alan Whelihan, U.S. Department of Commerce Office of Metric Programs, addressed the ANSI Board of Directors on the latest developments within the federal government related to metrication.

ANSI is pleased to have the opportunity to address any questions that you or members of the subcommittee may have.

Sincerely,

Manuel Peralta
President

MP/2129h

NAM

National Association
of Manufacturers

HOWARD LEWIS, III
Vice President
International Economic Affairs

June 22, 1989

The Honorable Doug Walgren
Chairman, Subcommittee on Science,
 Research and Technology
Committee on Science, Space and Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Walgren:

Members of the National Association of Manufacturers face a problem of having their exports closed out of foreign markets because they do not comply with foreign certification or standards requirements. It is bad enough when this happens because a foreign nation is specifically trying to erect trade barriers to American products. It is even worse when this happens because the United States fails to respond to a request for help from another nation in developing their national certification and standards policies.

This is exactly the situation that the United States now confronts. Nearly a dozen nations have asked the United States for assistance in developing technical standards for many of their products. Japan, West Germany, Great Britain and others are actively engaged in providing assistance. The U.S. Government has responded to such requests, however, by saying it does not have the resources to provide such assistance either through the National Institute of Standards and Technology (NIST) or other federal agencies.

Yet, the Trade Act of 1988 states that a function of NIST is to "cooperate...with the governments of other nations and international organizations...in establishing standard practices, codes, specifications, and voluntary consensus standards." This law represents three years of hard work to improve U.S. trade policies. The United States must now follow through not only in terms of market access but also in terms of taking the necessary steps to support U.S. exports.

For this reason, the NAM supports the approach taken in Rep. Dymally's bill, H.R. 2468. The association believes responding to requests for assistance is a meaningful way the U.S. Government can promote U.S. exports and that such assistance can be coordinated and funded by the U.S. Government. The attached memorandum on U.S. export policies (specifically pages 7-8) more fully explains the issue.

The NAM therefore encourages you to support H.R. 2468 when you are considering the 1990 authorization for NIST. Thank you for your consideration of this matter. I would be pleased to discuss this or any other issue raised in the attached memorandum with you at your convenience.

Sincerely,

Howard Lewis

Enclosure

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NAM

June 13, 1989

MEMORANDUM

Subject: **A U.S. Export Drive**

By: Howard Lewis III, Vice President-International Economic Affairs
National Association of Manufacturers

Overview

Americans have heard a lot about export-led growth in other nations such as Japan, Germany, South Korea and Taiwan. For the past two years, however, it has been the United States' turn to experience this type of growth. In 1987, exports directly accounted for 30% of U.S. economic expansion and for nearly 40% in the past year.[1] Working with latest available date, a new Commerce Department study found that in 1986 4.6 million jobs in this country depend upon exports.[2] This figure is undoubtedly even higher today given export growth in 1987 and 1988.

While these numbers are encouraging, now is not the time for complacency over the continuation of U.S. export growth. In 1989, U.S. exports are expected to increase by only 15% compared to the 23% expansion seen in 1988.[3] A recent poll of executives on NAM's Board of Directors found that 44% expected their exports to increase this year, 54% expected them to remain about the same and 2% anticipated a drop. It is clear that much of U.S. export growth resulted from the realignment of the dollar since 1985, with little coming from a concerted U.S. export drive. And, the big boost from the dollar may have run its course. That is why the United States should be looking for ways to launch a major drive to keep the current export boom going (some examples of the elements in such a drive can be found on page 2).

Supporting U.S. exports makes sense. It fits with the need to shift the U.S. economy towards increased investment, savings and overseas markets and away from domestic consumption and government spending. It provides a boost to the most competitive sectors of our economy spending. It is a logical and necessary follow-on to the market opening initiatives mandated in the 1988 Omnibus Trade and Competitiveness Act.

We should not underestimate the contribution which continued export growth can make in reducing the U.S. trade deficit. Paul McCracken, former Chairman of the Council of Economic Advisors, goes so far as to argue in a recent Wall Street Journal editorial that "the key to the U.S. trade problem is not bloated imports but weak exports. Even in 1988, after a sharp recovery, exports were only 6.6% of U.S. output.

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ELEMENTS OF AN EXPORT DRIVE

ISSUE	IMPACT ON TRADE/EXPORTS	POLICY RECOMMENDATIONS
EXIMBANK: Cuts in Exim direct loan budget of 85% since 1981 have left U.S. in a weak position to counter other official finance programs.	OECD nations still offering **$7-9 billion** yearly in direct credits while great uncertainty exists over financing U.S. direct loan budget.	Maintain Exim direct loan budget at current levels, use guarantee program to rejuvenate commercial financing, establish appropriate treatment of Exim in overall federal budget.
TIED AID/MIXED CREDITS: Other Industrial nations are offering mixed credits/tied aid (i.e., combination of foreign aid and official export financing) to gain strategic positions in key markets.	Mixed credit/tied aid offers in the neighbor-hood of **$15 billion** annually.	Provide greater support for capital goods projects under U.S. foreign aid and implement a credible mixed credit program.
EXPORT PROMOTION: U.S. Foreign Commercial Service (FCS) needs to be strengthened to match programs of other nations.	U.S. spends **.50 cents** per capita on export promotion versus **$2.00** in West Germany, **$4.00** in France, **$5.00** in Japan, and nearly **$8.00** in Canada.	Provide greater resources for FCS and address serious management and morale problems found in recent GAO report.
PRODUCT STANDARDS: U.S. has not acted on requests from Saudi Arabia, China, Brazil, India and five other nations for assistance in development of product standards. Other nations have responded to requests.	Harmonization of standards by Saudi Arabia and other nations in the Gulf region alone could increase U.S. export by **$100-300 million.**	Establish program in Commerce Department to respond to these requests for development of product standards.
TAXATION OF EXPORT INCOME: Until recently, Treasury Department has proposed changes which would increase the tax on income earned by U.S. manufacturers exporting to overseas affiliates.	Current regulations contribute as much as **$5 billion** annually in exports to U.S. trade and generate **170,000 jobs.**	Abandon any further attempts at such changes.
EXPORT DISINCENTIVES: Largest disincentive is probably U.S. export control system on so-called "dual use" commercial products.	National Academy of Science estimated that **$9 billion** in exports lost each year due to cumbersome system that requires **40% manufactured experts** get prior approval before leaving U.S.	Implement 1988 Trade bill provisions to reduce licensing requirements, scope of control list, limit unilateral controls and decontrol low tech exports.

compared with just over 8% in 1980."[4] He maintains that "further sustained and large improvement in our external trade is not apt to occur unless U.S. businesses become hungrier for export orders. And the origin of that must be less expansive domestic monetary and fiscal policies."[5]

To some extent, the lack of prominence given to U.S. export policies may be due to the widespread view that exporting, at least by itself, does not represent a viable corporate strategy for competing in today's highly interdependent, global market. Indeed, investment in overseas plants and facilities has become a cornerstone in the overall competitive strategy of many U.S. multinational firms. Exports however, still play a central role in this strategy as evidenced by the fact that shipments between American parents and their foreign affiliates account for 30% of total U.S. exports. Moreover, exports undoubtedly will play a larger role in the competitive strategies of many medium-sized U.S. firms. In order to achieve greater economies of scale in their domestic production, these firms must seek out markets on an international rather than domestic scale. This phenomenon is already seen among medium-sized, high technology firms in this country which typically export between 30 to 40 pecent of their output. In short, exporting will remain a vital part of U.S. corporate strategy for competing in today's international markets.

An export drive by itself, of course, will not eliminate U.S. trade problems. To believe that would be naive. We clearly must focus on recapturing our own domestic markets, lost to foreign competitors during the years of the high dollar, 1981-85. And we must pursue an overall program that addresses the federal budget deficit, exchange rates and the opening of foreign markets. Sound macro-policies are essential to restoring the competitiveness of U.S. industry. It is important to realize, however, that export related policies ranging from financing to taxation cannot be dismissed as relatively unimportant, peripheral matters.

Large amounts of trade are heavily influenced by these policies.[6] For example, as will be discussed below, over $5 billion in exports are generated each year by the foreign source tax rule on exports. While the Eximbank faces continued uncertainty over its direct loan program, other industrial nations offer $7-9 billion a year in direct credit export financing. Over $15 billion in mixed credit offers were made last year by our competitors--offers which the U.S. is essentially unable to counter. And, nearly $9 billion in exports may be lost because of our cumbersome export control system which requires that 40% of our manufactured exports--$60 billion in trade--get prior approval from the government before leaving the country.

The potential payoff of a U.S. export drive, therefore, could be considerable. We can be sure, however, that other major industrial nations will not easily give up the export markets they captured during the 1981-85 "super dollar" era. As exchange rate adjustments narrow the price gaps between the U.S. and our competitors, government support for exports, whether in terms of export financing, elimination of export disincentives, or aggressive overseas commercial services, will play an important role in successful efforts to compete for export business around the world.

This will be especially true in the most competitive of U.S. industrial sectors--capital goods--which accounts for 45% of U.S. manufactured exports.

Elements of an Export Drive

Examples of some immediate policy actions to encourage continued export growth include:

1. Strengthening the Eximbank: Export financing is the weak link in U.S. export expansion. with Eximbank resources totally inadequate to meet the needs of U.S. exporters. The Bank had to close its doors to new direct loan business three-quarters of the way through 1988 and is expected to shut down even earlier this year because of uncertainty over funding. Over the past nine years Eximbank's direct loan budget has been cut by 85%. Other OECD nations. however. have continued to offer significant amounts of official export financing--most recent data indicates in the neighborhood of $7-9 billion per year.[7]

American exporters will find less export financing help from commercial banks many of whom have abandoned export financing over the past decade. As noted in a 1988 report by the House Banking Subcommittee on International Finance. Trade and Monetary Policy. ''exporters and U.S. leaders are heading in the opposite directions. While exporters face increased international competition and higher levels of risks--needing financing support to compete--the U.S. commercial banks have become adverse to foreign risks and are scaling down their international lending. including export financing.''[8] For those U.S. banks which have maintained trade relating financing. the Subcommittee report found that over 50% was import rather than export related.[9]

In a survey of nearly 100 U.S. exporters conducted as part of the House Subcommittee report. 66% of the responding companies found that competitive export financing was only ''sometimes'' or ''rarely available'' and 53% stated that they had lost export business because of the lack of competitive financing. Almost 55% of the companies indicated that. if more export financing were available. they would export more.[10]

A strengthened Eximbank that can support a rejuvenated commercial financing sector should be the linchpin of a U.S. export drive. At a minimum. this will require maintaining Eximbank's direct loan budget at current levels. In addition. the Bank's guarantee program should be used aggressively to encourage commercial bank involvement in export financing. In the longer term. attention must be given to the treatment of the Exim in the Federal budget where Exim authorizations are counted as expenditures rather than loans repaid with interest. This deficiency significantly overstates the real impact of the Exim on the budget.

2. Trade and Aid: Closely related to official export financing offered by agencies such as Eximbank is the issue of tied aid/mixed credits in which foreign aid and official export financing are combined to achieve more attractive financing terms. As

international agreements to limit official financing practices really began to take hold in the mid-1980s, most industrial nations moved the game over to the playing field of tied aid/mixed credits, where the rules were less restrictive.

U.S. foreign assistance programs in the mid-1970s, however, had virtually abandoned the use of aid in support of capital project assistance in favor of a narrowly defined basic human needs approach to development aid. This orientation contrasts sharply with the bilateral assistance programs of other industrial nations. The extent of the difference can be seen in the following figures representing the percent of bilateral foreign aid going to capital goods projects by other donor nations:[11]

Japan	45.8%
Denmark	33.0%
Norway	22.5%
Germany	20.8%
Italy	17.0%
United Kingdom	15.4%
Canada	14.0%
Sweden	13.3%
France	13.0%
United States	2.3%

In analyzing this data, it should be remembered that Japanese bilateral foreign aid now exceeds that of the U.S.

In theory, if no link existed between the capital project assistance and the commercial interests of donor nations, we would not have to be concerned about this issue since American firms would have an equal opportunity when bidding on these projects. In practice, of course, matters are a great deal more complicated. OECD data indicates that tied aid/mixed credit offers increased from $11 billion in 1986 to over $15 billion in 1987.[12] Such credit offerings appear to have increased by approximately 400% since the early 1980s, even though various OECD agreements during this time were supposed to curb such practices.

A U.S. strategy for dealing with tied aid/mixed credits should include the following elements: 1) provide greater support for capital goods projects as a legitimate and necessary means of promoting economic development and U.S. trade interests in those nations receiving such aid (e.g., Egypt, Pakistan, Turkey); 2) further strengthen current foreign aid programs which leverage the impact of U.S. assistance. The Trade and Development Program (TDP), which supports feasibility studies and training programs, is a good example of this type of assistance; and 3) put forward and forcefully implement a credible mixed credit program which focuses on key markets in the developing world (e.g., China, India) which receive little, if any, foreign assistance and hence would not be eligible for the capital project assistance noted above.

3. Beefing up export promotions: Of the major industrial nations, the United States provides the least support in terms of export promotion and assistance. Commerce Department data indicates that the U.S. spends about 50 cents per capita on export promotion, compared to about $2.00 in West Germany, $4.00 in France, $5.00 in Japan and nearly $8.00 in Canada.[13] The U.S. has only a few more commercial officers overseas than South Korea--a nation with one-seventh the amount of trade.[14]

Besides the funding and the number of officers assigned overseas, recent reports from the General Accounting Office (GAO) and other sources have identified serious management and morale problems with the Foreign Commercial Service (FCS) and U.S. export promotion efforts. A GAO report issued in January of 1988 stated that Commerce Department export promotion efforts were plagued by "poor event selection, marketing, and recruitment and a lack of accountability for either positive results or failures." The report found that 55% of scheduled trade shows do not take place.[15] GAO staff reviewed promotion activities in four Latin American nations and found that 40% of the trade events proposed for those countries involved sectors not listed as good export opportunities in reports prepared by the foreign commercial posts.[16]

The GAO report examined the Commerce Department's Commercial Information Management Systems (CIMS) and concluded that the program may "continue to languish with only minimal capability if its technical and resource problems are not addressed by senior Commerce officials."[17] CIMS represents the third time in 10 years the Commerce Department has attempted to develop a computerized trade information system.

In the short term, the Secretary of Commerce and top policy officials in International Trade Administration should ensure that qualified career officials are appointed to top FCS jobs, that U.S. trade missions target the sectors of greatest opportunity, and that accountability exists for the running of trade events and support programs. In the longer term, however, it is clear that basic issues must be addressed in strengthening the FCS.

The 1988 Omnibus Trade and Competitiveness Act attempted to address some of these issues. Among other things, it provided statutory authority for the FCS, directed that senior Commercial Service Officers be given the rank of Minister-Counselor in eight U.S. Embassies, and assigned FCS officers to the U.S. Executive Director offices in the World Bank and other multilateral development banks (MDB) in order to promote U.S. exports in MDB procurement.

This is certainly a start at improving U.S. export promotion but a number of matters remain to be dealt with. For example, greater attention needs to be given to the coordination of U.S. commercial policies among the FCS, country desk officers, and industry specialists in the Commerce Department. Steps should be taken to ensure that the FCS has enough standing in the hierachy of American embassies to get the job done. We should examine how effectively the State Department carries out trade promotion in embassies to which no FCS officers are assigned. These are all important matters which need to be addressed in efforts to strengthen the FCS.

4. Product Standard Development: Strengthening the FCS is only part of the effort that needs to be undertaken to protect and support U.S. exports. Attention must also be focused on how the U.S. deals with actions taken by other countries that affect U.S. trade interests. While this is an extremely broad subject, a good example of what often needs to be done can be seen in recent requests the U.S. Government has received from various nations asking for assistance in the development of product standards. The quality of a product usually is not the issue here but rather regulations governing the uniformity of the size, material and performance of a product. Such regulations govern whether a product actually can be sold within a particular nation or region. This is why the standard-setting aspects of EC-92 have gained such widespread attention and concern from U.S. industry.

While the EC is not asking for official U.S. help in actually developing its standards, other nations are doing so. The U.S. Government has received such requests from Saudi Arabia, Brazil, China and six other nations. The Government maintains that it does not have the resources, either financial or technical, to assist other nations with developing such criteria. The net effect of this may be that U.S. products are being shut out of important export markets.

A case in point involves the Saudi Arabian Standards Organization (SASO). Saudi Arabia has adopted a "national standard concept" like many other industrialized nations. Under these national standards arrangements, commodities and goods that do not conform to these standards cannot enter the country. SASO also is developing import standards for the Gulf Cooperation Council, which is comprised of Saudi Arabia, Kuwait, Oman, Bahrain, Qatar and the United Arab Emirates. The Gulf Cooperation Council is the 12th largest U.S. export market, buying nearly $5 billion worth of goods in 1987. The Commerce Department estimates that with increased harmonization of standards and certification procedures for U.S. electrical, electronic and food products, U.S. exports to the Gulf Cooperation Council could potentially increase by $100-$300 million a year.[14]

In the fall of 1987, the Saudi Ministry of Commerce asked that the United States provide funding for a full-time standards expert to be assigned to SASO. The U.S. Government has responded to the Saudi request by suggesting the alternative of a privately-funded expert rather than a government official. This alternative is now being pursued.

While the United States remains uninvolved in foreign standards setting, other nations have become very actively involved. Industrialized countries including Britain, France, West Germany, Japan, Australia and New Zealand work closely with SASO staff to ensure that the standards developed do not shut their country's products out of the Saudi market. Through government-to-government agreements, these countries have technical experts at SASO and the governments pay the bills. They also educate their domestic manufacturers about SASO criteria to facilitate easy entry for their products into the country.

The situation in Saudi Arabia and SASO is an immediate problem that will be solved, if at all, with a stopgap measure. A privately-funded expert to work with SASO may be acceptable this one time, but a series of privately-funded standards experts assigned to countries around the world hardly seems to be a viable solution or the best policy in the long run. The SASO example simply points out the need for a long-term solution to the problem. Eight other nations including China, Brazil, India and Israel have already made similar requests for technical assistance in the development standards.

5. Make no further adverse changes in the taxation of export income. Over the past several years, the Treasury Department has been considering modification of the "export source rule." Under this decades-old interpretation of the nation's income tax laws, export profits generally are allocated 50% to U.S. sources and 50% to foreign sources. Throughout the period 1984-88, this rule was under attack by the Treasury, which first sought to have Congress repeal it as part of the 1986 tax reform legislation, and, when that failed, to reinterpret the rule administratively.

Treasury's attempted reinterpretation of the export source rule was vigorously opposed by NAM and other members of the Export Source Coalition. Late in 1988, Treasury relented in part, at least for the time being, and stated that exporters could continue to use the 50/50 rule except in cases where there was an "independent factory price" that could be used as the basis for allocating profits. While not entirely satisfactory, this resolution may prove adequate if it is reasonably applied by IRS auditors.

The impact of the export source rule is significant. One study, U.S. Export Competitiveness and Source-of-Income Rules, found that the current rule contributes as much as $5 billion annually in exports and generates nearly 170,000 jobs.[19] This study also concluded that the rule was particularly important in stimulating exports of high technology products by small firms. Faced with continuing large trade deficits, it simply makes no sense for U.S. tax policy to discourage exports by increasing taxes on export-related income. Treasury should abandon any further attempted changes of this sort.

6. Continue to eliminate or modify unnecessary export disincentives: The U.S. places more obstacles in the way of its exporters than any other industrial nation. Example of these export disincentives include the Foreign Corrupt Practices Act, two anti-boycott statutes, foreign policy export controls, national security export controls, and a variety of restrictive measures on organizations such as Overseas Private Investment Corporation and Eximbank which limit the ability of these agencies to support American exports. While all of these policies are intended to achieve laudatory goals, they often fly in the face of international commercial reality, ensnarling U.S. firms in red tape and extraterritorial application of U.S. laws and policies.

Changes in the Foreign Corrupt Practices Act (FCPA) contained in the 1988 Omnibus Trade and Competitiveness Act, demonstrate that it is possible to modify these export disincentives to eliminate some of the unintended impact on U.S. international commerce while at the same time maintaining the basic purpose of the statute. The recent changes in the FCPA provide a clearer guideline of what is acceptable and unacceptable behavior under the law. Their implementation will help ensure that legitimate business opportunities are not lost because of uncertainty over how the FCPA would be applied.

Perhaps the largest export disincentive facing American business today is the U.S. export control system. The National Academy of Sciences (NAS) in a 1987 study estimated nearly $9 billion in exports were lost each year because of our cumbersome export control system which requires that 40% of manufactured exports--$60 billion of commercial products--get prior approval from the U.S. Government before leaving the country.[20]

The NAS study focused on national security controls. The U.S., of course, maintains another set of controls for foreign policy reasons which have periodically embroiled the U.S. in major disputes with our allies and seriously damaged the reputation of U.S. firms as reliable suppliers. A case in point are the foreign policy controls on the export of U.S. petroleum equipment to the Soviet Union which started in 1978 and expanded in 1980-81. The Commerce Department estimated that U.S. firms lost nearly $2 billion in business before these controls were lifted in 1987.[21]

The 1988 Omnibus Trade and Competitiveness Act contained some important provisions which could:

1) significantly lessen licensing requirements for exports to the group of allies known as Cocom countries;

2) reduce the scope of the control list;

3) limit unilateral U.S. controls; and

4) decontrol low technology exports.

Implementation of these provisions over the next year will be important. In the past, progress has been stymied by inter-agency conflicts. It is vital that the leadership of top policymakers, especially in the White House, be exerted to ensure that these important reforms are carried out and that U.S. control policies are directed toward realistic and practical goals.

7. Other Actions: The preceding are some examples of policy initiatives that could be taken immediately to launch a U.S. export drive--with minimum impact on the U.S. budget. In the longer run, other steps could be taken such as continuing to promote the development of export trading companies, consolidating the two anti-boycott

statutes, and examining ways to boost U.S. trade with Eastern Europe, the Soviet Union, and China. We need to carefully review our policies towards arms exports to avoid the type of multibillion dollar loses experienced when Saudi Arabia in the mid-1980s decided to purchase British rather than U.S. military aircraft. The antitrust reforms proposed in 1988 by former Commerce Secretary Verity and former Attorney General Thornburgh have identified another major policy issue which needs to be reexamined as we look for ways to encourage greater industry collaboration on research and development.

In addition, over the longer term, we need to learn more about the very nature of U.S. exporting. This will involve answering some very basic questions. For example, what is the breakdown for the size and frequency of U.S. export transactions? Are U.S. exports generally small shipments of say $5,000 or less, or larger shipments of $25,000 or more? How many shipments does a typical U.S. exporter make in a year--200, 500, 1,000? Is there any relationship between the frequency of exporting and the size of the shipments. And how do the answers to the preceding questions vary among different industrial sectors? Only recently have we begun to develop data to answer such questions.[13] The answers may hold very important policy implications for how we should or should not go about encouraging greater U.S. exporting, especially among small/medium sized firms.

Conclusion

You cannot talk about an export drive without putting the question into the larger context of what the United States as a nation is willing to do to ensure its competitive position in international markets. The NAM has long argued that a national commitment to international competitiveness is the single most important step to be taken in developing a strategy for correcting U.S. trade problems. From this commitment flows the support necessary to implement policies that will increase our international competitiveness.

We often have paid lip service to this idea, but have done very little to adapt our policies or institutions to the new realities of international competition. Other nations have adjusted to these new realities. But in this country, government-business relations are still driven by an outdated adversarial tradition more suited to the beginning of this century rather than its end.

If the embassies or official financing institutions of other nations do a better job of supporting their commercial interests overseas, it is more a reflection of the importance they attach to international trade than it is a condemnation of our FCS or Eximbank. We cannot make the FCS or the Eximbank as good as our competitors unless we are willing to assign trade a much higher national priority than it now enjoys. In short, we get what we pay for: to date the United States has not been willing to pay the price in terms of putting aside other national priorities in order to support our international commercial interests.

FOOTNOTES

[1] "The U.S. Export Boom: Causes and Effects." Business America. U.S. Department of Commerce. October 24. 1988. p. 7-11.

[2] Exports from Manufacturing Establishments. 1985 and 1986. Analytical Report Series. Bureau of the Census. U.S. Department of Commerce. 1989.

[3] "Export Growth May Slow to Half of Last Year's Role". Journal of Commerce. February 9. 1989.

[4] "Why U.S. Exports Are a Casualty". Wall Street Journal. March 3. 1989.

[5] Ibid.

[6] Sources for the figures cited in this paragraph can be found in the main body of the text.

[7] Report to the U.S. Congress on Export Credit Completion. U.S. Export-Import Bank. 1988. p. 5.

[8] Export Financing in the United States: Problems and Options. Committee on Banking. Finance and Urban Affairs. U.S. House of Representatives. December 1988. p. 4.

[9] Ibid. p. 10

[10] Ibid. p. 5

[11] Ernest H. Preeg. "Trade. Aid and Capital Projects". Washington Quarterly. Winter 1989. p. 176.

[12] Statement of The Honorable John A. Bohn. President and Chairman. Export-Import Bank of the United States before the House Banking Subcommittee on International Finance. Trade and Monetary Policy. February 25. 1988. p. 19.

[13] "Assistance for Exporters". Trade and Industry. National Association of Manufacturers. May 23. 1988.

[14] The Commercial Services of the United States and Its Major Competitors. U.S. Department of Commerce. October. 1983.

[15] Export Promotion: Problems in Commerce's Programs. U.S. General Accounting Office. January 1989. p. 32.

[16] Ibid. p. 35-37.

[17] Ibid. p. 61.

[18] "A Missed Export Opportunity". Trade and Industry. National Association of Manufacturers. October 10. 1988.

[19] Balancing The National Interest. National Academy Press. 1987.

[20] Hufbauer. Gary C. and Hammond-Tooke. A., U.S. Export Competitiveness and Source-of-Income Rules. Report for Export Source Coalition. January 1988.

[21] Foreign Policy Report to Congress: January 21. 1985 - January 20. 1986. U.S. Department of Commerce. p. 38.

[22] Commerce Department Press Release. June 2. 1989 regarding Bureau of the Census Report on manufactured exports.

American Businessmen's Group of Riyadh

مجموعة رجال الاعمال الامريكيين في الرياض

11 July 1989

Mr. Doug Walgren
Chairman
Science, Research and Technology
2819 Rayburn House Office Building
Washington, D.C. 20515
U.S.A.

Dear Mr. Walgren:

We urgently need your support. We urge your active endorsement of HR2468 now under consideration by the Subcommittee on Science, Research and Technology.

In a nutshell, the issue is this: There is a pressing need for the United States to dispatch a standards specialist to Riyadh to provide American input in the development of domestic product standards now being established by the Standardization and Metrology Organization of the Gulf Cooperation Council (GCC) countries: Saudi Arabia, Kuwait, Bahrain, the United Arab Emirates, Oman, and Qatar. Without this U.S. input, American manufacturers run the risk of being inadvertently excluded from this major U.S. export market, which absorbed $5.7 billion of American products last year. Some American products are already being excluded by enforcement of new standards.

Our commercial competitors, including Japan, West Germany, Britain, Holland, Finland, India, New Zealand, and even Singapore, have responded to the open Saudi invitation to participate in the standards development process. Japan and West Germany each have 15-man teams at the Riyadh headquarters of the GCC Standardization and Metrology Organization. The United States has yet to find a way to send even one representative. At a time when our trade deficit is a key national concern, it is difficult to understand the lack of serious commitment by our Government to promote exports.

As you may already be aware, Representative Mervyn Dymally on May 24 introduced an amendment to the authorization bill for the National Institute of Standards and Technology (NIST) which has recently been sent to the Subcommittee on Science, Research and Technology for consideration. This amendment authorizes funds for a pilot program to place a U.S. standards specialist in Riyadh who would assist in the development of industrial standards for the Gulf.

P.O. Box 8273
Riyadh 11482, Saudi Arabia

ص.ب ٨٢٧٣
الرياض ١١٤٨٢ - المملكة العربية السعودية

Specifically, the bill authorizes an appropriation to the Secretary of Commerce of $200,000 for each of the fiscal years 1990 thru 1992 to establish this pilot program, under Section 112 of the National Institute of Standards and Technology Authorization Act for Fiscal Year 1989 (PL 100-519).

We expect debate on this bill will center on whether such a program should be privately or publicly funded. We strongly contend that the program is deserving of sustained funding by the U.S. Government. An adequately funded pilot program would pay for itself a thousand fold by insuring that existing and potential U.S. exports are not excluded from the Gulf market. The U.S. Embassy in Riyadh has estimated that if Saudi Arabia and U.S. standards were harmonized, U.S. exports may increase by as much as $500 million per year. As you are aware, an increase of exports of this magnitude could generate 15,000 new U.S. jobs and increased millions of dollars in tax revenues. This policy program also offers an inexpensive test case. If the pilot program reaps dividends in the Gulf, similar programs could do the same in other important foreign markets.

On behalf of myself and the approximately 16,000 American businessmen working in the Gulf region, I respectfully urge your support of this important legislation.

We ask that you please contact Subcommittee Chairman Doug Walgren to express support for the Dymally amendment (HR2468). Beyond that, we would also urge you to convey your endorsement of the $200,000 annual appropriation to Representative Neal Smith, Chairman of the Appropriations Subcommittee covering the Department of Commerce.

Thank you for your support on this important issue.

Sincerely yours,

FRANK M. HARDY

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K.S.A. 31932
FAX (966-3)857-2284

June 6, 1989

The Honorable Doug Walgren
Washington, D.C. 20515-3818

Dear Congressman Walgren,

I am writing to you regarding the Dymally amendment to HR2468, now under consideration before your Subcommittee on Science, Research and Technology. We in the Arabian Gulf American Businessmeens Groups wholeheartedly endorse and support this critical legislation. We urge your active support as well.

In a nutshell, at issue is American exports and American jobs. As you may be aware, Rep. Mervyn Dymally on 24 May introduced an amendment to the authorization bill for NIST, which we understand has been sent to your Subcommittee for consideration. This amendment authorizes funds for a pilot program to place a US Standards expert in Riyadh, who would assist in the development of national product standards for Saudi Arabia and the GCC States.

Specifically, the amendment authorizes an appropriation to the Secretary of Commerce of $200,000 for each of the FY 1990 - 1992, to establish this pilot program under Section 112 of the NIST Authorization Act for FY 1989 (PL 100-519.)

We expect the debate on this amendment will focus on whether such a program should be privately or publicly funded. We strongly contend that the program is deserving of sustained funding by the US Government. An adequately funded program would pay for itself many times over from the tax revenue earned from US jobs and exports created or retained through insuring that US goods are not excluded from the Gulf market. The US Embassy in Riyadh has estimated that if US and Saudi/GCC standards were harmonized, US exports might increase by $500 million per year in Saudi Arabia alone.

Aside from the pragmatic or direct "payout" argument, we believe that this program should be created with public funds for the following reasons:

- The US has no single industry-wide product standards coordinating body, such as exists in our competitor nations. Thus, there is no place to turn for general US standards advice and counsel. NIST remains the only body with, albeit remotely, a product standards Dept. oc overview position. Thus, there is no broad based, industry-wide organization who could sponsor such a project on behalf of the private sector.

- As such, it is difficult to raise private funding from US exporters, because the benefit to each is not directly measurable. Also, the benefits are spread over thousands of US companies, many of these small and unknowledgeable of the problems awaiting them.

P. O. Box 88, Dhahran Airport, Dhahran 31932, Saudi Arabia. Telex: 870028 WTKA SJ. Fax: 03-857-8130. Tel.: 03-887-0666

- The US companies which will be most impacted are the many small to medium sized companies who are new to the export game. These companies will have great difficulty in adapting their products to accommodate national standards newly imposed by their recently found customers.

Statistics have shown that the recent US "export boom" has been led by just this group of companies. It will be a tragic step backwards if we allow these fledgling exporters to become disenchanted by technical trade barriers which could be within our control through adequate attention to providing US assistance to those key markets now developing national standards.

We encourage and solicit your full support for the Dymally amendment, as an advocate of both increased and fair US trade, and as a leader in sending a positive signal to the US business community that Congress is demonstrably committed to supporting our front-line troops in the trade trenches. In addition to your support in the Subcommittee, we ask that you convey your endorsement to Rep. Neal Smith, Chairman of the Commerce Subcommittee on Appropriations.

Sincerely,

Howard A. Campbell
Director, American Businessmen's
Association - Eastern Province

THE LAW FIRM OF SALAH AL-HEJAILAN
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TO
The Honorable Doug Walgren
Chairman
Science, Research and Technology
U.S. House of Representatives
2319 Rayburn House Office Building
Washington, D.C. 20515

FAX NUMBER

FROM
Gerald B. Hosenkamp
LFSH - Riyadh

Dear Representative Walgren,

Re: ABGR Door-Knock Standardization Follow-up

I advocate the assignment of a government-funded expert on product standards to the Saudi Arabian Standards Organization (SASO) in Riyadh, which currently is formulating product standards that will be adopted by all six nations of the Gulf Cooperation Council (GCC). This crucial issue, if not properly addressed, could effectively exclude US products ranging from refrigerators and cosmetics to electrical substations from entering the GCC market, a major export outlet for American products.

Legislation must initially clear both the Appropriations Subcommittee on Commerce and the Subcommittee on Science, Research, and Technology to fund a small program to provide this input, and we need your support for this legislation.

In a nutshell, the issue is this: There is a [illegible] need for the United States to dispatch a standards

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specialist to Riyadh to provide American input in the development of domestic product standards now being established by the Standardization and Meteorology Organization of the Gulf Cooperation Council (GCC) contries: Saudi Arabia, Kuwait , Bahrain, the United Arab Emirates, Oman and Qatar. Without this U.S. input, American manufacturers run the risk of being inadvertently excluded from this major U.S. export market, which absorbed $5.7 billion of American products last year. Some American products are already being excluded by enforcement of new standards.

Our commercial competitors, including Japan, West Germany, Britain, Holland, Finland, India, New Zealand, and even Singapore, have responded to the open Saudi invitation to participate in the standards development process. Japan and West Germany each have 15-man teams at the Riyadh headquarters of the GCC Standardization and Meteorology Organization. Yet, the United States has yet to find a way to send even one representative. At a time when our trade deficit is a key national concern, it is difficult to understand the lack of serious commitment by our government to promote exports.

Representative Marvyn Dymally introduced an amendment RH 2468 to the authorization bill for the National Institute of Standards and Technology (NIST). This bill was recently sent to the Subcommittee on Science, Research and Technology for consideration. The amendment authorizes funds for a pilot program to place a U.S. standards specialist in Riyadh who assist in the development of industrial standards for the Gulf.

Specifically, the bill authorizes an appropriation to the Secretary of Commerce of $200,000.00 for each of the fiscal years 1990 through 1992 to establish this pilot program, under Section 112 of the National Institute of Standards and Technology Authorization Act for Fiscal Year 1989 (PL 100-519).

I expect debate on this bill will center on whether such a program should be privately or publicly funded. I strongly contend that the program is deserving of sustained funding by the U.S. Government. An adequately funded pilot program would pay for itself a thousandfold by ensuring that existing and potential U.S. exports are not excluded from the Gulf market. The U.S. Embassy in Riyadh has estimated that if Saudi Arabian and U.S. standards were harmonized, U.S. exports may increase by as much as $500 million per year. An increase of exports of this magnitude could generate 15,000 new U.S. jobs and millions of dollars in tax revenues. This pilot program also offers an inexpensive test case. If it reaps dividends in the Gulf, similar programs could do the same in other important export markets.

On behalf of myself, and the approximately 16,000 American businessmen working in the Gulf region, I respectfully urge your support of this important legislation.

Beyond that, I would also urge you to convey your endorsement of the $200,000.00 annual appropriation to Representative Neal Smith, Chairman of the Appropriations Subcommittee covering the Department of Commerce.

Thank you in advance for your support on this important issue.

Sincerely yours,

Gerald B. Hosenkamp
The Law Firm of Salah Al-Hejailan

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JUL 24 '89 15:55 AMOCO SHJ OIL CO. 009716355142 P.1/3

Amoco Sharjah Oil Company

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United Arab Emirates
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Tlx 68685 AMCOSH EM
Fax 355142

D. F. Vahrs
President
& General Manager

J.T.

23 July, 1989

The Honorable Doug Walgren,
Chairman,
Subcommittee on Science, Research & Technology,
2242 Rayburn House Office Building,
Washington, D.C. 20515.

Dear Gentlemen:

Representatives of our regional American Businessmen's Associations visited Congressional offices in late April to discuss the need for American standards input to the Saudi Arabian Standards Organization (SASO) so that the U.S. does not lose export sales to this growing market in the Arabian Gulf.

Our Businessmen's Associations advocate the assignment of a government-funded expert on product standards to the Saudi Arabian Standards Organization (SASO) in Riyadh, which currently is formulating product standards that will be adopted by all six nations of the Gulf Cooperation Council (GCC). This crucial issue, if not properly addressed, could effectively exclude U.S. products ranging from refrigerators and cosmetics to electrical substations from entering the GCC market, a major export outlet for American products.

In a nutshell, the issue is this: There is a pressing need for the United States to dispatch a standards specialist to Riyadh to provided American input in the development of domestic product standards now being established by the Standardization and Metrology Organization of the Gulf Cooperation Council (GCC) countries, Saudi Arabia, Kuwait, Bahrain, the United Arab Emirates, Oman, and Qatar. Without this U.S. input, American manufacturers run the risk of being inadvertently excluded from this major U.S. export market, which absorbed $5.7 billion of American products last year. Some American products are already being excluded by enforcement of new standards.

Our commercial competitors, including Japan, West Germany, Britain, Holland, Finland, India, New Zealand, and even Singapore, have responded to the open Saudi invitation to participate in the standards development process. Japan and West Germany each have 15-man teams at the Riyadh headquarters of the GCC Standardization and Metrology Organization. Yet, the United States has yet to find a way to send even one representative. At a time when our trade deficit is a key national concern, it is difficult to understand the lack of serious commitment by our Government to promote exports.

Representative Mervyn Dymally introduced an amendment HR 2468 to the authorization bill for the National Institute of Standards and Technology (NIST). As Chairman of the Subcommittee on Science Research and Technology, we urge you to support NR 2468, a pilot program to place a U.S. standards specialist in Riyadh who would assist in the development of industrial standards for the Gulf.

As you are aware, the bill authorises an appropriation to the Secretary of Commerce of $200,000 for each of the fiscal years 1990 through 1992 to establish this pilot program, under section 112 of the National Institute of Standards and Technology Authorization Act for Fiscal Year 1989 (PL 100-519).

Aside from the pragmatic or direct "payout" argument, we believe that this program should be created with public funds for the following reasons:

> The U.S. has no single industry-wide product standards coordinating body, such as exists in our competitor nations. Thus, there is no place to turn for general U.S. standards advice and counsel. NIST remains the only body with, albeit remotely, a products standards overview position. Thus, there is no broad based, industry-wide organization who could sponsor such a project on behalf of the private sector.
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>
> The U.S. companies which will be most impacted are the many small to medium sized companies who are new to the export game. These companies will have great difficulty in adapting their products to accommodate national standards newly imposed by their recently found customers.

Statistics have shown that the recent US "export boom" has been led by just this group of companies. It will be a tragic step backwards if we allow these fledgling exporters to become disenchanted by technical trade barriers which could be within our control through adequate attention to providing U.S. assistance to those key markets now developing national standards. If this pilot program proves its worth in the Gulf, then the concept will no doubt be enlarged to encompass the other affected markets as well.

An adequately funded pilot program would pay for itself a thousandfold by insuring that existing and potential U.S. exports are not excluded from the Gulf market. The U.S. Embassy in Riyadh has estimated that if Saudi Arabian and U.S. standards were harmonized, U.S. exports may increase by as much as $500 million per year. An increase of exports of this magnitude could generate 15,000 new U.S. jobs and millions of dollars in tax revenues.

On behalf of myself and the approximately 16,000 American businessmen working in the Gulf region, I respectfully urge your support of this important legislation.

Thank you in advance for your support on this important issue.

Sincerely yours,

D.F. Vehrs

DONALD F. VEHRS

CBI Eastern Anstalt

P. O. Box 2750
Dubai
United Arab Emirates

23 July 1989

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research, and Technology
2241 Rayburn House Office Building
Washington, D.C. 20515

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Cont'd /3......

On behalf of myself and the approximately 16,000 American businessmen working in the Gulf region, I respectfully urge your support of this important legislation.

Thank you in advance for your support on this important issue.

Sincerely yours,

G. Dvoroznak

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الإمارات العربية المتحدة

بناية ارنكو رقم واه
الدور ٢ ، شارع زعبيل
ص. ب ٢١٥٥ دبي – أ.ع.م.
تليفون : ٣٧٣٢٢٠
تلكس : ٤٥٥٤٤ كالتكس ايام
فاكس : ٩٧١-٤-٣٧٢٩٦٧

Jim Turner
Carol

24 July 1989

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research,
and Technology
2241 Rayburn House Office Building
Washington, D.C. 20515.

Dear Mr. Chairman:

Representatives of The American Business Council of Dubai and other regional American Businessmen's Associations visited Congressional offices in late April to discuss, amongst other matters, the need for American standards input to the Saudi Arabian Standards Organization (SASO) so that the U.S. does not lose export sales to this growing market in the Arabian Gulf.

Our Businessmen's Associations advocate the assignment of a government-funded expert on product standards to the Saudi Arabian Standards Organization (SASO) in Riyadh, which currently is formulating product standards that will be adopted by all six nations of the Gulf Cooperation Council (GCC). This crucial issue, if not properly addressed, could effectively exclude US products ranging from refrigerators and cosmetics to electrical substations from entering the GCC market, a major export outlet for American products.

Thus there is a pressing need for the United States to dispatch a standards specialist to Riyadh to provide American input in the development of domestic product standards now being established by the Standardization and Metrology Organization of the Gulf Cooperation Council (GCC) countries: Saudi Arabia, Kuwait, Bahrain, the United Arab Emirates, Oman, and Qatar. Without this U.S. input, American manufacturers run the risk of being inadvertently excluded from this major U.S. export market, which absorbed $5.7 billion of American products last year.

Our commercial competitors, including Japan, West Germany, Britain, Holland, Finland, India, New Zealand, and even Singapore, have responded to the open Saudi invitation to participate in the standards development process. Two major exporter nations, Japan and West Germany, each have 15-man teams at the Riyadh headquarters of the GCC Standardisation and Metrology Organization. Yet the United States has yet to find a way to send even one representative. At a time when our trade deficit is a key national concern, it is difficult to understand the lack of serious commitment by our Government to help American businesses promote exports.

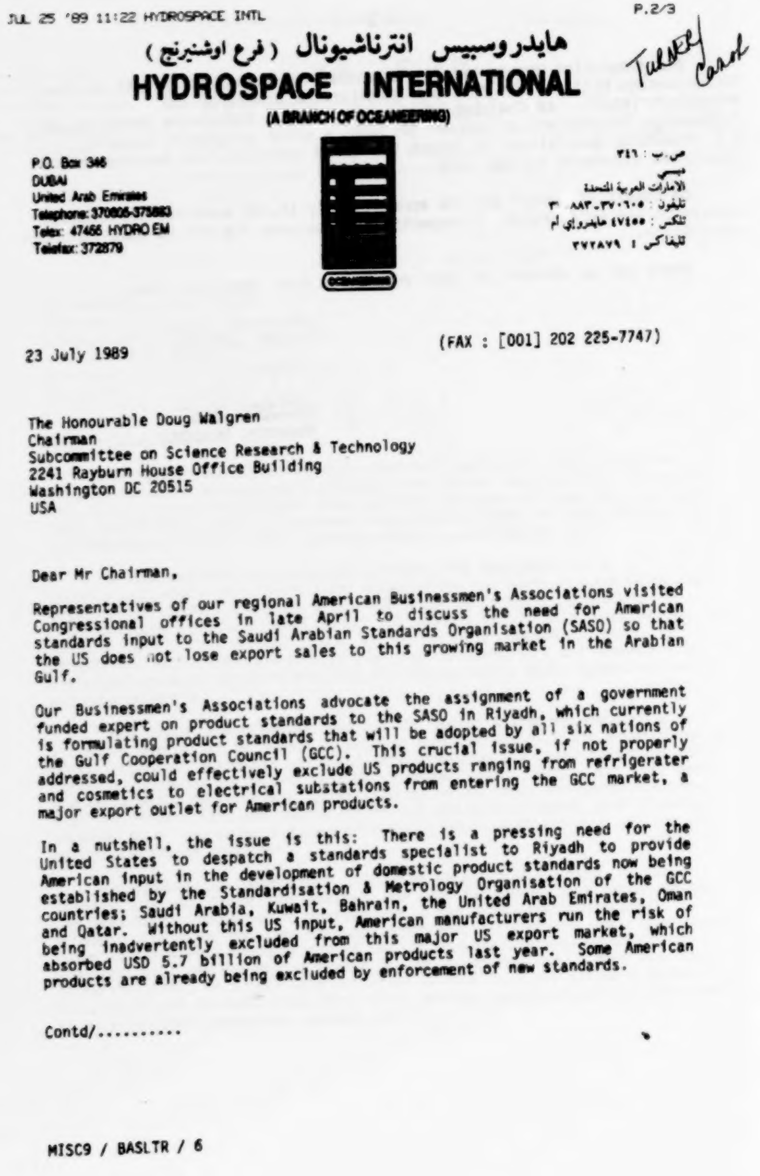
Representative Mervyn Dymally introduced an amendment HR 2468 to the authorization bill for the National Institute of Standards and Technology (NIST). As Chairman of the Subcommittee on Science Research and Technology, we urge you to support HR 2468, a pilot program to place a U.S. standards specialist in Riyadh who would assist in the development of industrial standards for the Gulf.

On behalf of myself and the approximately 16,000 American businessmen working in the Gulf region, I respectfully urge your support of this important legislation.

Thank you in advance for your support on this important issue.

Sincerely yours,
CALTEX ALKHALIJ

EDWARD J. OLD
MANAGING DIRECTOR



JUL 25 '89 11:22 HYDROSPACE INTL P.2/3

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HYDROSPACE INTERNATIONAL

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ص.ب : ٣٤٦
دبي
الامارات العربية المتحدة
تليفون : ٣٧٠٦٠٥-٣٧٥٨٨٣
تلكس : ٤٧٤٥٥ هايدرو اي ام
تليفاكس : ٣٧٢٨٧٩

Turner Carol

(FAX : [001] 202 225-7747)

23 July 1989

The Honourable Doug Walgren
Chairman
Subcommittee on Science Research & Technology
2241 Rayburn House Office Building
Washington DC 20515
USA

Dear Mr Chairman,

Representatives of our regional American Businessmen's Associations visited Congressional offices in late April to discuss the need for American standards input to the Saudi Arabian Standards Organisation (SASO) so that the US does not lose export sales to this growing market in the Arabian Gulf.

Our Businessmen's Associations advocate the assignment of a government funded expert on product standards to the SASO in Riyadh, which currently is formulating product standards that will be adopted by all six nations of the Gulf Cooperation Council (GCC). This crucial issue, if not properly addressed, could effectively exclude US products ranging from refrigerater and cosmetics to electrical substations from entering the GCC market, a major export outlet for American products.

In a nutshell, the issue is this: There is a pressing need for the United States to despatch a standards specialist to Riyadh to provide American input in the development of domestic product standards now being established by the Standardisation & Metrology Organisation of the GCC countries; Saudi Arabia, Kuwait, Bahrain, the United Arab Emirates, Oman and Qatar. Without this US input, American manufacturers run the risk of being inadvertently excluded from this major US export market, which absorbed USD 5.7 billion of American products last year. Some American products are already being excluded by enforcement of new standards.

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Our commercial competitors, including Japan, West Germany, Britain, Holland, Finland, New Zealand and even Singapore, have responded to the open Saudi invitation to participate in the standards development process. Japan and West Germany each have 15 man teams at the Riyadh headquarters of the GCC Standardisation & Metrology Organisation. Yet, the United States has yet to find a way to send even one representative. At a time when our trade deficit is a key national concern, it is difficult to understand the lack of serious commitment by our Government to promote exports.

Representative Mervyn Dymally introduced an amendment NR 2468 to the authorisation bill for the National Institute of Standards & Technology (NIST). As Chairman of the Subcommittee on Science Research & Technology, we urge you to support NR 2468, a pilot programme to place a US standards specialist in Riyadh who would assist in the development of industrial standards for the Gulf.

As you are aware, the bill authorises an appropriation to the Secretary of Commerce of USD 200,000 for each of the fiscal years 1990 through 1992 to establish this pilot programme, under Section 112 of the National Institute of Standards & Technology Authorisation Act for Fiscal Year 1989 (PL 100 - 519).

Aside from the pragmatic or direct "playout" argument, we believe that this programme should be created with public funds for the following reasons :

> The US has no single industry-wide product standards co-ordinating body, such as exists in our competitor nations. Thus, there is no place to turn for general US standards advice and counsel. NIST remains the only body with, albeit remotely, a product standards overview position. Thus, there is no board based, industry-wide organisation who could sponsor such a project on behalf of the private sector.
>
> As such, it is difficult to raise private funding from US exporters, because the benefit to each is not directly measurable. Also the benefits are spread over thousands of US companies, many of these small and unknowledgeable of the problems awaiting them.
>
> The US companies which will be most impacted are the many small to medium sized companies who are new to the export game. These companies will have great difficulty in adapting their products to accommodate national standards newly imposed by their recently found customers.

Statistics have shown that the recent US "export boom" has been led by just this group of companies. It will be a tragic step backwards if we allow these fledgling exporters to be disenchanted by technical trade barriers which could be within our control through adequate attention to providing US assistance to those key markets now developing national standards. If this pilot programme proves its worth in the Gulf, then the concept will no doubt be enlarged to encompass the other affected markets as well.

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An adequately funded pilot programme would pay for itself a thousandfold by ensuring that existing and potential US exports are not excluded from the Gulf market. The US Embassy in Riyadh has estimated that if Saudi Arabian and US standards were harmonised, US exports may increase by as much as USD 500 million per year. An increase of exports of this magnitude could generate 15,000 new jobs and millions of dollars in tax revenues.

On behalf of myself as part of the American Business Community working in the Gulf region, I respectfully urge your support of this important legislation.

Thank you in advance for your support on this important issue.

Sincerely yours,

BARRY SMITH
MANAGING DIRECTOR

AUG 3 '89 15:14 FROM BWIP PAGE.002

BWIP International, Inc.

Corporate Headquarters

200 Oceangate Boulevard [illegible]

Long Beach California [illegible]

Telephone [illegible] Fax [illegible]

VIA FAX

AUG [illegible]

SRT

August 3, 1989

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research,
  and Technology
2241 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

I respectfully urge your support of the very important legislation that will provide a government funded expert on product standards to the Saudi Arabian Standards Organization (SASO) in Riyadh, which currently is formulating product standards that will be adopted by all six nations of the Gulf Cooperation Council (GCC). This crucial issue, if not properly addressed, could effectively exclude U.S. products ranging from refrigerators and cosmetics to electrical substations from entering the GCC market, a major export outlet for American products.

Our company is very much involved in that area of the world and in competition with manufacturers from countries whose industry/government cooperation quite often puts us at a disadvantage. U.S. government support of this program would pay for this by a thousandfold by insuring that existing and potential U.S. exports are not excluded from the Gulf market.

Sincerely,

Peter C. Valli
President and CEO

/par

AUG 3 '89 15:13 FROM BWIP PAGE.001

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Telecopy Transmittal Form

Date: August 3, 1989

To: The Hon. Doug Walgren Office: FAX: 202/225-7747 Wash. D.C.

From: Peter C. Valli Office: Long Beach, CA

Subject: ____________ cc: ____________

Page 1 of 2